ON THE LIMPETS; WITH SPECIAL REFERENCE TO THE SPECIES OF THE WEST COAST OF AMERICA, AND TO A MORE NATURAL CLASSIFICATION OF THE GROUP.

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Malacologists have long felt the need of a revision of the *Cyclobranchiata* of Cuvier. In this paper the results of a careful examination of a large number of species are detailed, and an approximation to a more natural classification of the Limpets has been attempted. The task has been by no means easy, yet it is hoped that some light has been thrown upon the subject, and the way made easier for the application of information which may be gleaned in the same field by other authors.

Historical Notes on the Nomenclature.

Throwing out the more incongruous forms which were included in the genus Patella of Linnæus, we find the majority of the patelliform shells included by Cuvier (1817) in his order *Cyclobranchiata.* Lamarck (1818) placed them among his *Phyllidiens.* Férussac (1819) with a clearer perception of their characters, adopting *Cyclobranchiata* as the name of an order, formed for the Patellidæ a suborder, *Schismobranchia*,* placing the chitons in another, which he called, after Blainville, *Polyplaxiphora.*†

Latreille (1825) divided the *Cyclobranchiata* into two families, (*Scutiformes* and *Lamellés*) corresponding to the sub-orders of Férussac, except that in the former he unwisely included with the Patellæ, the genus *Umbraculum*, Schum. (*Umbrella*, Lam.)

Blainville, in the same year, used the terms *Schismobranchiata* and *Cyclobranchiata*, to include heterogeneous and unnatural groups of other mollusks, while he formed an order, *Cervicobran-*

* Not *Schismobranchia*, Blainv., *Schismobranchiata*, Blainville, Risso; nor *Schismatobranchia*, Gray.

† Afterwards corrected by Gray to *Polyplacophora.*

chiata, including two families; (1.) *Retifera* for the *Patellidæ*, and (2.), *Branchifera* for *Fissurella*, *Parmaphorus* and *Emarginula*. He also unfortunately transferred the chitons to his "Sub-type" *Malentozoöria*, which last was composed of the Cirriped crustaceans (*Nematopoda*) and the Chitons (*Polyplaxiphora*).

Rang in 1829 considered the *Patellidæ* and *Chitonidæ* as forming an order, for which he adopted Cuvier's name *Cyclobranchiata*.

Later, Gray (Guide to the Mollusca, 1857), placed the Limpets in two sub-orders—*Cervico-* and *Cyclobranchiata* forming part of his order, *Scutibranchiata*, sub-division *Heteroglossa*. The *Cervicobranchiata*, however, contains two families, the *Gadiniidæ* and the *Lepetidæ*, which cannot be affiliated with the typical members of the group.

The Messrs. Adams (Gen. Rec. Moll. 1858) however, must receive the palm for combining under one sub-order (*Edriopthalma*, but not=*Edriopthalma*, Gray) of the *Scutibranchiata*, a more heterogeneous collection of families, including the Limpets, than any other author (except their copyist, Chenu) has dreamed of doing. It cannot be said that any of these classifications were an improvement upon that of Férussac.

In 1861 (Wieg. Arch. II) Dr. F. H. Troschel proposed for the group of which the Limpets are the typical examples, the term *Docoglossa*, or plate-toothed. This was more fully defined by him in 1866, in the first part of the second volume of the "Gebiss der Schnecken," page 10. Though what would appear to be a want of appreciation of other and equally important characters, however, the Chitons and Dentalia were included in the same order, as by some previous authors. The same group was adopted by Moërch under the name of *Heteroglossata* and divided into the *Cyclobranchiata* i. e. *Patella*, *Chiton;* and the *Cirribranchiata* viz., *Dentalium*.

In the present state of our knowledge in regard to the embryology and anatomy of *Dentalium* and *Chiton*, these views can no longer be maintained, and the two groups indicated by these names in their widest sense, will take rank henceforth as distinct orders.

The order *Docoglossa*, as here restricted, was first recognized by me in a "Revision of the Classification of the Mollusca of Massachusetts," (Proc. Bost. Soc. Nat. Hist, xiii, p. 245, March, 1870), at which time only the characters of the sub-order *Abranchiata* had been fully worked out. Since that time I have investigated the characters of the sub-order *Proteobranchiata* as here restricted, and, in a paper read before the Am. Assoc. Adv. Sci.,

at the Troy meeting, Sept., 1870, (of which a synopsis was published in the Am. Naturalist, Nov., 1870, p. 561), I restricted the whole order within its present limits from the researches above mentioned. Among the fruits of these investigations was the definite exclusion of the *Gadiniidæ* from the order, (see Am. Jour. Conch. vi. p. 8, 1870). It is proper to state that, on general considerations, Prof. Theodore Gill, in his unpublished manuscripts, had adopted similar limits for the order, though the conclusions to which I have been led were the results of entirely independent investigations.

A brief synopsis of the order and its subdivisions as here adopted, was, for the sake of insuring priority, presented to the Boston Society of Natural History in September, 1870, and published *in advance* of the Proceedings, February 7th, 1871.

Formulating the Dentition.

Attempts have frequently been made, with greater or less success, to devise a method of formulating, mathematically, the different styles of dentition. Having used several methods, and finding them all more or less deficient in some particulars, I would propose the following as an improvement upon any now in use, and likely to meet any demands that can reasonably be made upon it. For greater compactness the formula may be written in the form of a fraction, with the rhachidian tooth as a numerator; the lateral teeth enclosed in brackets and the uncini outside of the brackets, as a denominator. The median line in the latter may be indicated by a period and the teeth of the lateral and uncinal series severally connected by a *plus* sign. Each separate tooth may be denoted by a fraction, the denominator representing the number of cusps, and if there is more than one tooth similarly formed, the numerator of the fraction will serve to indicate the number, For instance, suppose we have a radula with a median tooth possessing five cusps, this tooth would be indicated by a fraction thus $\frac{1}{5}$. If there were six inner laterals each with three cusps they would be formulated by the fraction, $\frac{6}{3}$; another lateral tooth outside of them with one cusp or entirely simple would be written $\frac{1}{1}$, and connected with the other six with a *plus* sign. Ten simple uncini on each side would form a fraction $\frac{1^{0}}{1}$, and the whole formula would be $\frac{\frac{1}{5}}{\frac{1^{0}}{1}(\frac{1}{1}+\frac{6}{3}\cdot\frac{6}{3}+\frac{1}{1})\frac{1^{0}}{1}}$. The absence of teeth in either series might be indicated by a cipher, thus $\frac{0}{\frac{1^{0}}{1}(\frac{1}{1}+\frac{6}{3}\cdot\frac{6}{3}+\frac{1}{1})\frac{1^{0}}{1}}$ or $\frac{\frac{1}{5}}{\frac{0}{0.0.}}$

This supposes that all the teeth are in one transverse line, but when, as in many patellæ, some of the laterals are in a series in advance of the rest, a *minus* sign would serve to indicate their relative position in substitution for the *plus* sign; as, $\frac{0}{3(\frac{1}{3}-\frac{2}{1}.\frac{2}{1}-\frac{1}{3})3}$ would signify a radula without a median tooth, in which the two simple inner lateral teeth on each side are in advance of the three cusped third lateral, and which was provided with three uncini. The advantage of the system is evident, from the small space in which a large amount of information can be compressed and yet remain perfectly comprehensible. It is true that it is slightly more complicated than that in use at present, but hardly so to an objectionable extent. When the cusps are quite simple the fractional form of the formula for each tooth may be dispensed with. The method thus indicated will be used throughout this paper.

General Remarks.

The dentition of the *Docoglossa vera*, has certain well marked characteristics not common to other groups. The radula is usually jointed, or rather divided by impressed transverse lines between each series of teeth and its neighbors. This flat section I shall term, for convenience, the *area*. The area is bounded on each side by a narrow smooth pleura, upon which the uncini are situated, if any exist. Upon the area are certain solid, more or less thickened, plates or bosses, of intricate form; generally, but not always, bearing teeth. These bosses are sometimes translucent, but are usually more deeply colored than the area, upon which they are solidly fixed. Upon the bosses are found strong, recurved, hooked teeth, almost invariably black and opaque. The teeth are readily detached from the bosses; in fact, with specimens long preserved in alcohol, it is difficult to obtain any part of the ribbon with the cusps undisturbed, while the bosses cannot be detached from the area by any means short of the destruction of both. The radulæ of this group are apparently less purely chitinous than those of the *Pulmonata*, *Rhachiglossa*, &c., as they cannot be boiled in potash for an instant without detaching all the cusps from the bosses, and in a very short time the greater portion of the radula itself will be destroyed. Even soaking in a weak potash solution, quite cold, in order to cleanse the structure, must not be long protracted, or the latter will become disorganized. All the species are furnished with a more or less cartilaginous jaw, which is also destructible in potash.

The *Docoglossa*, as a group, manifest what may be termed a

peculiar persistency of immaturity, when compared with other groups of Gasteropods. The embryonic shell is dish-shaped, according to Carpenter and Fischer, and this form is persistent in the adult. The dentition is characterized by a want of solidification of the chitine, especially in the *Patellidæ*, and the teeth of some forms are represented by mere undeveloped bosses in others, and even these are absent in a third series. In no group are the fundamental outlines of the bases of the teeth so difficult to make out or represent by figures. Their variation, within certain limits, is noticeable, and a tendency to melt one into another, so to speak, may frequently be observed. The teeth can be clearly separated into three series, median or rhachidian, lateral and uncinal. The lateral teeth are distinguished from the uncini by being situated upon the *area*, while the uncini are invariably upon the *pleuræ*.

The order is obviously separable by the dentition into two groups, viz., those with lateral teeth and those without them. The first is almost invariably destitute of a rhachidian tooth; in one form (*Acmæa* as restricted) we find no uncini or median teeth; in another (*Ancistromesus*, n. g.) we find all of the series represented; but, throughout the group the lateral teeth are persistent and three in number. The second group is furnished with a large and prominent rhachidian tooth and several uncini.

These differences are coördinated by others in the soft parts. Those possessing lateral teeth are also furnished with eyes and branchiæ. Those without laterals are also destitute of the above mentioned organs.

The latter comprise the family *Lepetidæ*, and will take the subordinal name of *Abranchiata*.

As the examinations detailed in this paper show that the suborders *Cyclo-* and *Cervico-branchiata* are not separable from each other by any characters whatever, being combined in some instances in a single individual; and as the terms above mentioned convey an error, *inter se*, and have also been applied to other groups, I shall propose for the group formed by their consolidation the subordinal name of *Proteo-branchiata*.

The *Proteo-branchiata* are divisible into two groups, by anatomical characters as well as the dentition; though the shells afford no high diagnostic characters. These comprise, 1st, those possessing a distinct cervical branchia and without a median tooth, and not more than two uncini. 2d, those without a cervical branchia, with or without a median tooth, and with three uncini on each side.

The first group will form the restricted family *Acmæidæ*, and the second the *Patellidæ*. Both groups are furnished with three

lateral teeth variously disposed upon the area, on each side of the median line.

The following synopsis will indicate the various groups and their characters with special reference to the species of the north-west coast of America. With regard to the species mentioned their synonymy, when not given, will be found at length in the excellent papers of Dr. Carpenter, and the other works alluded to in the foot notes. The generic synonymy, which was not given in full by Dr. Carpenter, is here worked out, as far as the materials at hand will allow. The absence of a number of species of which the soft parts are unattainable at present, will be noted by the student. These gaps are to be regretted, but will doubtless be made good in time. Meanwhile, sufficient information has been obtained to render our knowledge of a number of groups moderately complete, and while it is possible that the examination of the soft parts of the many species yet unknown except by the shell, may add several groups to those already eliminated, still it is probable that a very large proportion will fall naturally into the genera here indicated.

The materials upon which the following approximation to an arrangement of the limpets is based are as follows: For the species of the north-west coast of America, upon my own rather considerable collections in that quarter, and those of the Scientific Corps of the W. U. Telegraph Expedition, under my charge; comprising many thousand specimens, both in a dry and an alcoholic condition, and obtained in a range extending from San Juan del Sud, on the west coast of Nicaragua to Bering Strait; the large collections of the Smithsonian Institution, named by Dr. P. P. Carpenter, whose knowledge and careful consideration of the subject is excelled by none; and specimens collected by Messrs. Stearns, Cooper, Rowell, Swan and others in the same collection. For the *Patellidæ* and most of the species not from the north-west coast I am indebted to Dr. Wm. Stimpson, the Boston Society of Natural History, the Museum of Comparative Zoology at Cambridge, Mass., and to the collections of the Wilkes Exploring Expedition in the Smithsonian Cabinet, for examples. In this group my alcoholic materials have been more limited than among the *Acmæidæ*, yet they have been sufficient to establish the existence of several well marked groups not hitherto restricted. The notes on the colors and external appearance of the animals when not taken from my own notes, those of Mr. Couthouy, or some other author mentioned, are from the alcoholic specimens and, in some instances, perhaps may describe the general appearance of a few individual specimens rather than that of a whole race; any errors due to this

cause may, however, be corrected in time and with larger material. Great care has been taken, repetition has been made frequently in the description of minute characters common to several species in preference to leaving an opportunity for doubt as to the characters in each, by silence or cross references.

A certain geographical agreement in regard to generic characters has been observed, which, as far as it offers any grounds for speculation, rather favors the hypothesis of a development of the various forms from a few more simple and more closely allied ancestors. Thus, most of the species from the Straits of Magellan are provided with lateral frills on the foot, and also agree in having the laterals 2—1·1—2 (*Patinella*, *Nacella*); those of the British Seas on the other hand have the foot smooth and the teeth 1—2 · 2—1 (*Patella*, *Patina*); the Amboynese species of *Acmæidæ* agree in possessing two minute uncini instead of one, as in the west coast forms; the subgenus *Collisella* attains an extraordinary development upon the West American coast, and nowhere else, comparatively few species being known from other seas. On the other hand, certain sporadic forms, like the species of *Acmæa* occur in widely separated districts. These results, unquestionably due to some law, of which we have as yet only the vaguest intimations, I cannot attribute to the very plausible but highly unsatisfactory doctrine of "natural selection." No doubt the latter has had much to do in the vast field of nature, especially among plants, insects and birds, but there is no reason, except our own natural desire for a theory of some kind, for believing that it has had any appreciable effect on the development of the mollusca. I am impressed with the belief that there will ultimately be found to exist some law or laws far more profound and incisive, and as general and deep-seated as that elucidated by Mr. Darwin, governing without essential exception, the phenomena of evolution all over the globe.

Anatomical investigations from alcoholic specimens alone are very liable to error, from the rigidity of the parts, and this is especially true in regard to the finer details of the nervous and circulatory system. I have therefore attempted only a general outline of the anatomy of any of the species. The most noticeable differences between the two families Acmæidæ and Patellidæ are, that in the former a cervical branchia is present, the muzzle is provided with a frill,* there appears (in some species, at least) to be but a single renal organ, the crop is inconspicuous and the radula lies in a long double loop on the upper pos-

* Produced, in the subgenus *Acmæa* alone, into a lappet or tubercle at each side of the muzzle.

terior surface of the liver; in the latter there is no cervical branchia, the muzzle has no frill, there are two renal organs (according to Mr. Lankester), the crop is frequently large and prominent, and the radula is coiled on the anterior under surface of the liver. The branchiæ are subject in this suborder to the most extraordinary variations.

It will be noticed that the accompanying figures of *Collisella testudinalis* and *Patella vulgata* differ from those of Gray and Lovèn. The reason of this is that in the first case the long cusps of Gray's figure are due to the fact that they are broken down upon the cusps of the other laterals, instead of being represented in their natural position. In the case of *Patella vulgata*, strange as it may appear, though it has been often figured, I have not been able to find a single figure which expresses *all* the characters distinctly. Wilton's, in Woodward's Manual, is in some respects the best, but the tridentate cusp of the third lateral is so rendered that it appears as if it belonged to two teeth, and the uncini are poorly shown. Lovèn's figure is worse, but his figure of the teeth of *Acmæa virginea* is very good, and bears comparison with the object itself.

Care should be taken in figuring the dentition of any of the *Docoglossa* not to break down or crush the long slender cusps, or to confound the *bosses* which ornament the *area* with true cusped teeth. Bosses often occur, even on the pleura, without any tooth or cusp at all, and this should be carefully noted, but not incorporated into the formula. The central line is frequently indicated by an elongated narrow boss between the inner laterals, which is however barely perceptible and never carries a cusp. It is undoubtably the homologue of the rhachidian tooth, which only appears in this family in the single genus *Ancistromesus*. A sharp lookout should be kept for the minute uncini figured in *Collisella*, which are as readily overlooked.

The reader will notice a wholesale consolidation of generic names founded on trivial, inconstant and imaginary characters; yet, whenever practicable, the old and familiar names have been retained. In many cases, however, they have become so involved in a tissue of errors and confusion that it has been no easy matter to extricate the types and decide on their several claims. For the old and new generic names adopted in this paper, tangible, and it is to be hoped sufficient, characters have been given, in most cases, for the first time.

I have regarded as at least of subgeneric value decided differences in the branchiæ, in the dental formula, and, when accompanied by other characters, such a difference in the shell as for instance exists between *Patella vulgata* and *Patina pellucida ;*

the difference of the shell alone, however, is of minor importance, and without other characters affords no safe ground for classification, and is utterly unreliable in determining affinities.

In one case only am I in doubt as to the status of a name which I have here provisionally adopted. I refer to the subgenus *Helcioniscus*, which may require eventually to be merged in the genus *Helcion*. The dentition differs essentially from that of *Patina*, and the shells of both are widely removed from that of the typical *Helcion pectinatus*, of the Mediterranean, the only species of that genus as far as known; yet one or the other may prove eventually congeneric.

Unfortunately the dentition of the type of *Helcion* is unknown. When it shall be worked out the question can be satisfactorily settled. Meanwhile, rather than lose sight of the characters which are known, in *Patina* and *Helcionella*, I prefer to retain the three subgroups until we can unite or definitely separate them by actual knowledge of their relations.

I find, by wide comparison of specimens, that the forms indicated by the names *Cymbula*, *Scutellastra*, and even *Olana*, are due to habitat rather than specific characters, and merge imperceptibly one into another, in different and even in the same species; hence I feel justified in referring them to *Patella* as synonyms. *Scutellina*, again, doubtless contains species which should be referred to several groups already described, and very possibly some which may stand as distinct; yet the animal of the only species which has been described does not seem to differ at all from *Acmæa*, as far as we know its characters, and hence I prefer to omit the name in the series; giving it, with its own exclusive synonyms under it, as a probable synonym of *Acmæa*, Esch., in part, and for the remainder suspending judgment until we obtain more information.

With regard to the synonymy, no opportunity has been omitted of consulting the original descriptions, rather than the unreliable and often erroneous references of authors who have not taken the trouble of verifying their opinions. It is believed to be essentially accurate, and only liable to change from a more thorough examination of the characters of the type of *Helcion*.

Trusting that the result of my labor may be to throw some light upon an interesting and very complex subject, I would ask the coöperation of other students in extending these researches still further, and in correcting any of the almost inevitable errors which may be found in this as well as almost all similar work.

Class **GASTEROPODA.**

Order DOCOGLOSSA, Dall ex Troschel.

Suborder *ABRANCHIATA* (Gill) Dall.

Animal destitute of eyes or branchiæ, furnished with a rhachidian tooth and uncini, but without lateral teeth upon the radula.

Family LEPETIDÆ.*

Shell with apex anteriorly directed, patelliform; muzzle prolonged below in two tentacular appendages; teeth, $_2(\overline{0}\cdot\frac{1}{0})_2$.

Genus LEPETA, Dall ex Gray.

Subgenus LEPETA, Dall.

Rhachidian tooth tricuspid, concave in front. Central cusp much the largest, simple; lateral cusps small, emarginate. Base very broad. Uncini with simple cusps.

Subgenus CRYPTOBRANCHIA, Dall ex Midd.

Rhachidian tooth with three short cusps, equal and parallel before and behind, not pointed. Base more or less ornate behind, moderately broad. Uncini with simple cusps.

Subgenus PILIDIUM,† Forbes.

Rhachidian tooth tricuspid, convex before, central cusp much the largest, lateral cusps simply pointed; base very narrow. Uncini with cusps obliquely twisted.

Suborder *PROTEOBRANCHIATA*, Dall.

Animal branchiferous, oculiferous. Rhachidian tooth rarely present. Lateral teeth invariably present; three in number.

* For synonymy, &c., see "Materials for a Monograph of the Family Lepetidæ," by W. H. Dall, Am. Journ. Conch. v, pp. 140—150.

† Although Forbes and Hanley were acquainted with the *Lepeta cæca* of Müller, it would appear that they erected the *Patella fulva* into a distinct genus upon the erroneous supposition that the apex of *Lepeta* was directed posteriorly. The genus *Lepeta* is Atlantic, and *Cryptobranchia* is *Pacific*. in its distribution. I have seen no true *Lepeta cæca* from the Pacific, though it has been frequently reported from Japan and elsewhere. All the Pacific specimens sent by Dr. Carpenter under that name, and those in the Smithsonian collection dredged by Mr. A. Adams in Japan, and so denominated, upon inspection and actual comparison are undoubtedly different, and probably conspecific with *Cryptobranchia concentrica*, Midd.

Family ACMÆIDÆ, Cpr.

< *Phyllidiana*. Lam., Phil. Zool. 1809. Gld., Inv. Mass. Ed. 1, p. 146, 1841.
< *Patelladæ*, Guilding, Zool. Journal, iii, p. 535, 1828.
< *Patellaceæ*, Mke., Syn. Ed. 1828, *olim*. Hinds, Voy. Sulph. Zool. p. 53.
< *Patellacea*. Mke., Syn. Ed. 1830, p. 90. Forbes, Mal. Mon. p. 35, 1838.
< *Patellæ*, Fér., Tab. Syst. p. xxxvii, 1821. Rang, Man. p. 251, 1829. Desh., Enc. Méth. iii, 1830.
< *Patellidæ*, D'Orb., Moll. Can. 1837. Binn., Inv. Mass. Ed. ii, p. 267, 1870. Woodw., Man. p. 153. Cpr., Rep. Br. Assoc. 1856, p. 318. Jeffreys, Brit. Conch. iii, p. 229 (in *Pectinibranchiata*).
< *Fissurellidæ*, D'Orb., Voy. Am. Mér. v, p. 470, 1840. Rve., Conch. Syst. ii, p. 17. C. B. Ad., Pan. Sh. p. 241.
< *Fissurellina*, Macgill, Moll. Aberdeen, p. 65, 1843.
< *Patellina*, Wiegm., Handb. der Zool. p. 546, 1832. Milne-Edw. Conch. Textb. Ed. vi, p. 197.
< *Patelloidea*, Risso, Hist. iv, p. 260, 1826 (not of Férussac, Rang and Menke).
= *Lottiadæ*, Gray, Syn. Brit. Mus. 1840. Rev. Zool. p. 355, 1844 (in *Tectibranchiata*).
= *Lottidæ*, D'Orb., Moll. Cub. i, p. 93, 1841 (in *Scutibranchiata*.)
= *Tecturidæ*, Gray, P. Z. S. 1847, p. 158. Mrs. Gray's Moll. iv, p. 92, 158, 1850. H. and A. Adams, Genera Rec. Moll. i, p. 458. Dall., Rev. of the Classification of the Mass. Moll. Proc. B. S. Nat. Hist. 1870, p. 245.
< *Tecturidæ*, Gray, Guide Moll. 1857, p. 169.
< *Scutelliidæ*, Chenu, Man. de Conchyl. i, p. 374.
= *Acmæidæ*, Cpr., Maz. Shells, p. 202, 1856. Sup. Rep. Br. Assoc. 1863, p. 650. Am. Journ. Conch. ii, p. 332. Lect. on Moll. p. 71 (in *Scutibranchiata*).

Shell patelliform, subsymmetrical; animal with a free branchial plume above the left side of the neck. Radula with, or without uncini on each side, no median tooth, and often destitute of uncini; disk of the muzzle surrounded by a narrow frill of integument.

Genus ACMÆA, Esch., 1828.

Acmæa, Eschscholtz in App. Kotzebue's New Voyage round the World, &c. Dorpat, 1828. Colburn & Bentley's London translation, 1830, p. 350, vol. ii (no type or species named). Eschscholtz, Zool. Atlas, pt. 5, Ed. Rathke,

1833, p. 16, pl. xxiii and xxiv. (Type *Acmæa mitra*, Esch.) Forbes and Hanley, Brit. Moll. ii, p. 433. (Woodward, Man. p. 155.) Philippi, Handb. p. 199. Carpenter, Mazatlan Catalogue, p. 202. Lect. p. 71, Ed. ii. Sup. Rep. 1863, p. 650. Am. Journ. Conch. vol. ii, p. 332.

Tecture, Aud. and Milne-Edw. in Rep. of Cuvier on their three Memoirs. An. Sci. Nat. vol. xxi, p. 326, Nov. 1830. (Type *Patella parva?*)

Patelloida, Quoy and Gaim., Voy. Astrolabe, iii, 1833. (Type *P. rugosa*, Quoy *fide* Gray.) Encyc. Meth. iii, p. 704, 1832.

*Patella***, Loven, Ofv. af. K. Vetensk. Ak. För. June, 1847, p. 198. (*P. testudinalis*, L.)

Patelloidea, Cantraine, Diagnoses or descr. of some new sp. of Moll. Bull., Ac. Sci. Bruxelles, 1835. Also, Guerin, Bull. Zool. 1835, Livr. 7 & 8, Sect. 2, p. 129.

Lottia, Gray, Phil. Trans. 123, 1833, p. 800, note. (No type or species mentioned.) Ib. 125, 1835, p. 302. P. Z. S. 1847, p. 158.

Lottia. Gray, Syn. Moll. Br. Mus. 1840. Revue Zool. p. 355, 1844. Forbes, Mal. Monensis, p. 34, 1838. Moll. Ægean Sea, p. 135, 1844. Reeve, Proc. Zool. Soc. p. 75, 1841. Reeve and Catlow, Conch. Nom. p. 99, 1845. Möller, Index Moll. Grœnl. p. 16, 1842. Alder, Ann. and Mag. Nat. Hist. viii, p. 405, 1842. Macgillivray, Moll. Aberdeen, p. 65, 1843. Morris, Brit. Foss. p. 149, 1843. Gld., Otia Conch, pp. 9, 242. Moll. U. S. Exploring Exp. p. 349.

Patelloidea, Couthouy, Bost. Journ. N. H. ii, p. 171, 1839. (*P. amœna*, Say, = *testudinalis*) D'Orb., *olim*. Voy. Am. Mer. v. Chenu, Man. de Conchyl. i, p. 374.

Iothia, Forbes (err. typog.), Lond. Athen. Oct. 6, 1849, p. 1018) not = *Iothia*, Gray, Adams, Catlow).

Tectura, Gray, P. Z. S. 1847, p. 158, No. 275. Guide to Moll. p. 169. Mrs. Gray's Moll. iv, p. 92. H. and A. Ad., Gen. Rec. Moll. i, p. 458. Meek, Check List Cret. Inv. 1864, p. 17. Dall, Rev. Class. Mass. Moll. Proc. B. S. N. H. 1870, p. 245.

< *Tectura*, Jeffreys, Brit. Conch. iii, p. 245. Moërch, Cat. Yoldi, p. 143, 1852.

Helicon, Keferstein, Bronn. Klass. u. Ord. des Thier. iii, Mal. ceph. in reference to pl. 75, f. 6.

Scurria, sp. Gray, Adams, Cpr., op. cit.

Pileopsis, sp. Eichwald.

Helcion, sp. D'Orbigny, Voy. Am. Mér. v, p. 478; not Montfort.

Ancylus, sp. Costa.

Also, (to a greater or less extent, as yet undetermined):

Scutellina, Gray, P. Z. S. 1847, p. 168. (Type *S. crenulata*, Brod. sp.) Gld. Otia Conch. p. 242. Woodw., Man. Rec. and Foss. Shells, p. 155. Cpr., Lect. Moll. p. 71.

Scutella, Brod. (not Lam.), P. Z. S. 1834, p. 47. Müll., Syn. Test. Viv. p. 161, 1836. (*S. crenulata*, Brod.) Sby., Conch. Man. Ed. ii, pp. 225, 254.

Scutellina, H. and A. Ad., Gen. Rec. Moll. i, p. 460. Chenu, Man. de Conchyl. i, p. 375 (part).

Crepidula, sp. C. B. Ad., Pan. Shells, p. 234, No. 352.

The Latin designation of Eschscholtz (accompanied by a definite description) has two years' precedence of the trivial French name of Audouin and Milne Edwards, as mentioned by Cuvier. The *Réchérchès pour servir a l'histoire naturelle du Littoral de la France*, was published in 1832. It consisted of two volumes, the first being a general introduction, with some account of the fisheries, and the second is devoted to the Annelides. On page 144 of the first volume the authors state that they propose to create a new genus for some little rosy Patellas found on the coast of La Manche, on account of the peculiar cervical branchia, and that this genus is constituted in a resumé of their investigations offered to the Academy in November, 1829. No name of genus or type is mentioned.

Turning to the *Annales des Sciences Naturelles* (vol. xxi, p. 326) for November, 1830 (not 1829, as stated above), we find a report by Cuvier on three memoirs by the naturalists alluded to, in which he mentions "*leur genre Tecture*," but without giving any Latin name to it, and referring with doubt to *Patella parva* (= *virginea* Müll.) as the type.

Gray, in 1847 (P. Z. S.), appears to have been the first to give the name *Tecture* a Latin form; at least a very careful search has failed to reveal its publication anywhere previously.

Under the circumstances it seems extraordinary that the name should have been adopted by naturalists, and especially that we should find such allusions to it as those of Mr. Jeffreys in the British Conchology, vol. iii, p. 244–5. No one, we think, will hold that a Latin name should give place to a vernacular designation, even if the latter has priority, which it has not in the present case.

The animal of the typical species of *Scutellina* has not been examined, but that of a closely allied species, *S. ferruginea*,

from the drawing of Mr. *A. Adams* in the Gen. Rec. Moll., appears to agree in all essential particulars with *Acmæa*. Still it is not improbable that some of the species may prove to differ sufficiently from the Acmæas to retain a separate generic name. The anterior margin of some of them is almost straight, and one of these was described as a *Crepidula* by Prof. C. B. Adams.

The statement made by Forbes, and copied by Gray, Jeffreys and other authors, that the free branchial plume of *Acmæa* is equivalent to the circle of leaflets around the mantle of *Patella*, is manifestly erroneous. No one can examine the latter without perceiving that the two organs are not homologous; the lappets of *Patella* rise in a different place from the cervical branchia of *Acmæa*, they are supplied by different veins and nerves, and in those forms where the circle is interrupted before the head the ends of the cordon are far removed from the point of insertion of the cervical branchia. Nothing more is needed to show the erroneous nature of such a comparison after the discovery of species in which both the cordon and the cervical plume are found, as in *Scurria mesoleuca*. On the other hand, it is equally true that the cordon of *Patella* is not to be homologized with the respiratory organs of the Chitons. An examination of any species of *Chiton* will show that the branchiæ are, each in itself, of a radically different construction from those of *Patella*, each representing a plume furnished with transverse laminæ, analogous to the single plume of *Acmæa*. This conclusion is irresistible upon a careful examination of the branchiæ by any one possessed of a slight knowledge of comparative anatomy, and is fully confirmed by Dr. Williams in his admirable paper on the mechanism of aquatic respiration in invertebrate animals. (Ann. Nat. Hist. 1855, p. 413.) The branchial system of the Fissurellidæ, according to that author, differs widely from that of the *Docoglossa*, and the dentition and other anatomical details confirm his conclusions from the study of the branchiæ. The gills of *Emarginula* and *Propilidium* offer closer analogies with the Acmæidæ, but other characters show that their strongest affinities lie with the true Scutibranchs, though the dentition of *Propilidium* remains to be examined.

Blainville supposed that the function of respiration in *Patella* was carried on especially by a net work of vessels in the thin and delicate area of the mantle over the head, which I have termed the "hood." It is by no means improbable that this is the case in the *Abranchiata*, and to some extent the branchia in the *Patellidæ* may also be assisted by the mantle, though this is not yet proven. I have noticed in many species a most beautiful net work of vessels in this locality, which cannot be without an office of some kind.

The preceding synonymy refers to the genus *Acmæa*, Eschscholtz, as a whole, the following to the subgenus as now restricted.

Subgenus ACMÆA, (*sensu stricto*) Esch. Philippi., 1846.

Gen. char. Animal unprovided with a branchial cordon of lamellæ or any similar appendages between the mantle and the foot. Radula provided with three, subequal, similar, simple lateral teeth on each side, arranged in a line which forms an angle with the rhachis, each tooth being laterally and transversely parallel with the corresponding tooth in the opposite side, and the longitudinal axes of all the cusps being nearly or quite parallel with the median line of the radula which is destitute of uncini. Muzzle frill produced at the lower anterior corners into two lappets or tubercles. Shell solid, with an erect or anteriorly inclined apex.

Type ACMÆA MITRA, Esch. Plate, 14, fig. 1.

Syn. *Acmæa mitra*, (Esch.) Rathke. Zool. Atlas, part v. p. 18, No. 1, pl, xxiii, fig. 4.
Acmæa mammillata, Esch., ib., p. 18, No. 2.
Acmæa marmorea Esch., ib., p. 19, No. 3.
Scurria mitra, Gray, Adams, Cpr., &c., (pars.)
Lottia conica, Gld., Moll. U. S. Expl. Exp. p. 346, (maxima pars.)
Scurria? mitra, Dall, Am. J. Conch. v. p. 149, pl. xv, 1869.
Not *Scurria mitra*, Alcock (MSS.) Am. J. Conch. ii, p. 345 =*Scurria scurra* Less., nor
Scurria scurra, Lesson as aver Gray, Adams, D'Orbigny, and others.

Soft parts of a waxen white. Foot short, subcircular, smooth below and on the sides. Thickened portion of the mantle edge narrow, perfectly smooth all round, thinner portion ditto. Head short, stout; muzzle broad, transversely oval, furnished with a narrow, granulose frill which extends entirely around it, and at the lower corner on each side is produced into a sort of tubercle. Between these tubercles, below, the frill is very narrow. Disk of the muzzle granulose, radiately grooved. Mouth horseshoe shaped. Tentacles in the adult moderately long, cylindrical, very little swollen at the base, which is constricted without any tubercle on the inner side as in most of the *Patellæ*; tips bluntly rounded. The very young have the tentacles more swollen and pointed, proportionately. Eyes small, black, on the upper posterior bases of the tentacles. Gill stout, attached to the mantle a little to the left above the head; pointing forward a little to

the right; on the left side is a border formed by an impressed line which extends from the base to the apex of the organ; a large vessel sends forth branches to the lamellæ from this side. The laminæ are very prominent, so that the gill appears very thick and stout. Close to the adductor on the extreme right are (1) the anal tubercle, small, conical, pointing to the right, and (2) the infra-anal * papilla, smaller than the other and to the right of it. The renal orifice is probably very minute and situated to the left of the anal tubercle, but a thorough search failed to detect it. Intestine regularly and repeatedly constricted toward its termination, expelling the fæces in cylindrical pellets. In all the specimens examined it was full of white calcareous remains of nullipore.

Shell dull white, aperture nearly circular, wider behind, in some young examples somewhat elongated oval; form conical, apex erect, nearly central, blunt, smooth; posterior surface usually straight but occasionally a little convex, exterior smooth, marked with very faint concentric lines of growth; devoid of epidermis; margin entire, polished, with a narrow semi-pellucid rim inside. Internally smooth or furnished with grooves radiating from the apex more or less strongly marked. Muscular impressions deep, strong, horseshoe-shaped, with the marks of the anterior ends of the adductors rounded and broader than the rest, connected by a slender impressed line marking the attachment of the mantle. Young shells are often furnished with irregular riblets more or less strong, many or few in number, radiating from the apex but stronger towards the margin. Color, dead white inside and out, often livid, or tinged a fine pink or pea green from nullipore, but never wax yellow or horny pellucid as in the normal state of *Scurria scurra*. Formula

$$\frac{0}{0(1—1—1.1—1—1)0}.$$

I have been thus explicit because, by almost every author except Dr. Carpenter, this shell has been confounded with the South American species above mentioned; which, however, belongs to a different genus. Taken together, the most conservative conchologist would hardly think of uniting them; short descriptions and poor figures are mostly to blame for the confusion. The striated variety (*tenuisculpta*, Cpr.,) appears very distinct from the smooth form, but every gradation may be found in a very large series. The unique type of *Scurria? funiculata*, Cpr., now before me, differs from the smallest specimen of *tenuisculpta*, only in having the riblets even more prominent, close, and rounded, and being

* Infra-anal orifice of Lankester; see remarks under *Patella vulgata*.

thinner and smaller. It appears to me to be only a very marked, and probably individual, variation. It may, however, eventually prove conspecific with "*Patella*" *Lamanonii*, Schrenck, (Amurl. moll.) which is with little doubt the same as "*Patella*" *pallida*, Gld. (Proc. Bost. Soc. Nat. Hist. 1859.)

This species lives below low water mark, on stones; it ranges from the Aleutian Islands to San Diego, California. It is very abundant where Eschscholtz procured it, at Sitka, and equally so at Monterey. It is generally overgrown with nullipore which covers it with a regular series of nodules, and tinges the shell green or pink. Frequently a tuft of calcareous algæ waves from the apex, and the unconscious limpet literally bears a "feather in his cap." It feeds principally upon nullipore, and the encrusted variety seems to have constituted Eschscholtz' second species of *Acmæa* (*A. mammillata.*)

His first species is the one under consideration, and even if congeneric the name *Scurria* would have to make way for that of *Acmæa*, as the latter has eighteen years priority, and this species is the type *, including as it does the first three nominal species of Eschscholtz. Gray (1847) appears to have taken *A. scutum* (=*patina*) as the type, because on the plate the figure of *scutum* is numbered "1"; but it is really the sixth species of the list. The peculiar form and arrangement of the teeth, and the mouth-tubercles separate it from the rest of the Acmæids except, curiously enough, the type of the quondam genus *Tectura*, which is thus rendered an exact synonym of *Acmæa*. A pretty full account of the anatomy is given by Rathke, who published the last portion of Eschscholtz' Atlas, after the death of the latter naturalist.

Acmæa virginea, Müll. sp. Plate 14, fig. 2.

Patella virginea, Müll., Prod. p. 237, Zool. Dan. pl. 12, f. 4, 5.
Patella parva, Da Costa, Brit. Conch. p. 7, pl. 8, f. 11.
Patella pulchella, Fbs., Mag. Nat. Hist. viii, p. 591, f. 61.
Lottia pulchella, Brown Ill. Conch. Gt. Brit. ii, p. 480.
Tectura virginea, S. Wood, Crag. Moll. i, p. 161.
Acmæa virginea, Hanley, Brit. Marine Conch. p. xxxii. Fbs. and Hanl. Br. Moll. ii. p. 437.
Tectura virginea, Jeffr., Brit. Conch. iii, p. 248.

Soft parts mostly whitish, faintly suffused with pink; mantle edge thickened, fringed with unequal filaments a little within the

*This is the only species mentioned by Rathke in the generic diagnosis, and it was also adopted by Philippi as the type, in his review of the west coast limpets, in 1846.

margin. Foot oval, thin, sides smooth; head rosy, short, broad and semicircular; muzzle very short, frill produced into two lappets, as in the last species. Tentacles rather long, slender, pointed. Gill very long, drab, extensile and contractile, narrow and situated on the left side of the head, base a little forward of the junction of the neck and hood and springing from the under surface of the mantle, pointing from left to right across the neck and composed of a thin membrane bearing a series of lamellæ above, and another somewhat larger series below, as in most Acmæids. Anal and infra-anal papillæ as in the last, renal not detected. Formula $\frac{0}{0(1—1—1.1—1—1)0.}$

The specimens from which the above notes were taken were dredged by Dr. Stimpson near Oban, Scotland. It ranges from Iceland to the Azores (Jeffreys.) It has not the slightest resemblance whatever to *Acmæa asmi* of Middendorf, as suggested by Jeffreys (l. c.)

The shell has been well described by Forbes and Hanley, and Jeffreys, *op. cit.*

The statement of Clark in regard to the nidification of the ova, is too widely different from the habits of the other species to be taken without further confirmation; it is probably a misapprehension caused by the entanglement of some loose ova in the mucus of the foot.

ACMÆA INSESSA, Hinds. Pl. 14, fig. 3.

Patella insessa, Hds., An. Nat. Hist. x, p. 82, pl. vi, f. 3.
Nacella incessa, Cpr., Sup. Rep. Br. As. 1863, p. 650.

Soft parts slaty green, upper edge of mantle dark brown. Mantle and sides of foot smooth; tentacles cylindrical, stout, moderately long; eyes black, small on the upper posterior tentacle-bases, foot smooth, subovate; gill small, broad, triangular; muzzle frilled, disk granulose or nearly smooth, frill produced at each outer lower corner into two bluntly rounded lappets. Radula narrow, cusps reddish brown, rather more slender than in the last species. Formula $\frac{0}{0(1—1—1.1—1—1)0.}$ The specimen which affords the above notes was obtained from a Laminaria frond at Monterey. Range from Sitka (rare) to Monterey (common) and San Diego (scarce.)

In the young and perfect condition this shell has some very peculiar brilliant white marks on the apex which appear to consist, in a shell ·2 of an inch long, of a band in front of the apex, one just behind it, and a V-shaped mark still more posterior. These are, however, confined to the first and thinnest layer of the

shell and are soon worn, so as to present the appearance of six white dots radiating from the apex, and in all adult shells they are wanting. This strongly reminds one of *Scurria*, which has a white tip, sometimes marked with brown in a similar manner. The peculiar waxen, or semi-translucent, brown outer layer, also resembles the type of *Scurria*, which is also furnished with similar, radiating, fine striæ. I have a thin, long, compressed specimen exactly intermediate between the typical form and *A. paleacea*.

ACMÆA (?) INSTABILIS, Gld.

Patella instabilis, Gld., Proc. B. S. N. Hist. ii, 150, 1846, Exp. Shells 9.

Nacella instabilis, Cpr., Sup. Rep. Br. As. 1863, p. 650.

I have seen a large series of this species, but none with a perfect apex. It much resembles the last species, but appears to be specifically distinct. The principal difference is in the sculpture, which is in rather distant grooves instead of striæ, and in the size of the adult, which is much larger than the last species. The differences of form are probably due to a peculiar habitat. The place of this species would seem, from the close resemblance of the shell, to be probably in this division of the genus, but all classification (other than provisional) from the shells alone is time and work wasted. Neither this species nor the last, as far as we know, have any relations with *Nacella*, as restricted.

The species is rare at Sitka and Monterey and very common at Vancouver.

Subgenus COLLISELLA *, Dall.

Lottia, *Acmæa*, *Tectura*,, and *Patella*, sp. auct.

Animal without any vestige of a branchial cordon. Muzzle-frill simple, entire, not produced into lappets or tubercles. Radula with the two inner laterals anterior, approximate, simple, with long cusps; next two posterior, with large, broad usually simple cusps; outer laterals minute, closely appressed and opposed to the cusps of the second pair; pleuræ provided with one or two very minute uncini close to the posterior corner of the area. Formula $\frac{0}{2 \text{ or } 1(2—1.1—2)1 \text{ or } 2}$.

This subgenus differs from *Acmæa* in the simple muzzle-frill, the relative position and unequal size of the lateral teeth, and in the very minute uncinus, which from its small size, is very liable to be overlooked. The fact that the type of the genus

* From *Collis*, a mound; in allusion to their shape.

Tectura belongs to the restricted genus *Acmæa*, prevents the use of that name for this group for which it might have been advantageously employed.

The majority of the *Acmæidæ* of the West American coast belong to this section of the genus.

Section A, with one uncinus. (*Typica.*)

Type COLLISELLA PELTA, Esch. sp. Plate 14, fig. 6.

Acmæa pelta, Esch. Rathke Zool. Atlas, V. p. 19, No. 5.
+ (?) *Acmæa cassis*, Esch., ib. p. 19, No. 4, Pl. 24, fig. 3.
= *Patella fimbriata*, Gld., + *leucophæa*, Rve. + *monticola*, Nutt. MSS. (pars.) + *strigillata*, Nutt. MSS. (pars.) *fide* Cpr.

Soft parts: foot large, long, usually hiding the head when viewed from below; sides of foot smooth, blackish; mantle rather narrow, with a dark, broad, thick edge, furnished with a single row of minute beards or filamentous papillæ; head short and broad; tentacles stout, bluntly pointed, much swollen just above the somewhat constricted base, with a large tubercle at the inner base of each. Frill smooth, slightly crumpled, disk radiately striate with a granular border; mouth transversely oval. Gill short, acutely pointed with strongly marked borders, left margin conspicuously crenate. Inferior lamellæ larger than the upper ones, and the posterior laminæ below much more produced than the anterior ones. Anal papilla prominent, oblique, with a T-shaped orifice, pointing to the right. Infra-anal do. smaller, subcircular, deeply bifid. Renal orifice not elevated, situated some distance to the left of the anal papilla.

Liver small, linguiform. Radula short, forming a double loop on the upper surface of the liver. Crop medium in size, not laminated internally. Generative capsule divided by a deeply impressed transverse sulcus, from below, into two lobes. Formula $\frac{0}{1(2—1.1—2)1}$. Female examples had the sac full of ova in different stages of development, but afforded no special evidences of complexity of structure. On the other hand, the same organ in the males was a gland, composed of innumerable small tubes parallel with each other, perpendicular to the wall of the sac at their bases, where they were thick and frequently bifurcated, their internal extremity conical, pointed, and emptying into a central, irregularly-shaped cavity.

The whole structure recalled that of the kidney in vertebrates, but was coarser. The tubes separated readily from one another, were nearly smooth or lightly longitudinally striate; their sheaths

appeared to be composed of fine transversely striate fibres, disposed in wavy bands. They contained a smooth greenish substance, resembling coagulated mucus, and without any trace of organization, under a. $\frac{1}{10}$ Smith and Beck (55°) objective. The specimens here described were obtained at Black Point, San Francisco, in February.

Var. *nacelloides*, Dall, (MSS. 1865). Pl. 17, fig. 36 a–c.

A very distinct variety of this species has exactly the aspect of "*Nacella*" *instabilis* externally. It is of a blackish brown, with sharp, radiating grooves sometimes obsolete near the apex. Several shells beginning in this way have a margin with the normal characters of *C. pelta*. It is quite distinct from the var. *monticola*, Nutt., as described by Dr. Carpenter in the Amer. Journ. Conch., Vol. II, p. 33, and might readily be taken for a distinct species, as the sculpture differs entirely from that of the normal *pelta*, which is sparsely furnished with prominent bulging ribs. I am disposed to agree with Dr. Carpenter (Sup. Rep. p. 533,) in referring *A. pilcolus*, Midd., to "probably the young of *A. pelta*;" although I believe it impossible to determine exactly what *pileolus* really was.

Collisella patina, Esch. sp. Plate 14, fig. 4.

Acmæa patina, Esch., Zool. Atlas, V, p. 19, No. 7, pl. xxiv, f. 7—8. Cpr. Am. Journ. Conch. ii, p. 332.

Var. *normalis*, *sive pintadina*, (Gld.)

Shell depressed, rounded, with a wide tessellated border, and with the color in stripes or spots more or less tessellated; sculpture of sharp striæ. Soft parts: foot, mantle-edge and muzzle dusky. Top of head, neck and thin part of mantle whitish. Foot oval, thick, stout, sides quite smooth; mantle smooth, with a narrow thickened edge, ciliated, and with fine crenulations corresponding to the striæ of the shell; head short, broad, prominently bulging above. Tentacles moderate, pointed, stout, greatly swelled at the base, with a prominent tubercle at the inner corner of each. Muzzle transversely oval with an even, puckered, scalloped frill; disk entire, radiately striate, mouth transversely oval. Eyes minute, on outer posterior bases of the tentacles. Gill moderately long, subtriangular, with a strong impressed line, forming a border on each side; slightly attached by posterior edges to the mantle above; inserted on the under surface of the hood, above the left side of the head and some distance in front of the commissure between the mantle and neck. Anal tubercle smooth, not very prominent, pointing to the right, close to the right anterior end of the adductor; orifice internally

papillose, infra-anal orifice bifid, to right of anal, on a broad, not prominent swelling. Renal orifice round, minute, hardly elevated, some distance to the left of the anal papilla. The length and stoutness of tentacles differ in different individuals. Some varieties approach very closely to the black variety of *C. scabra.*

Var. *Cumingii*, (Rve.)

Shell elevated, compressed, with a narrow black or slightly spotted border; externally black, with small bluish white spots radiating from the apex and becoming elongated into stripes near the margin, in some individuals; quite or almost destitute of radiating striæ.

Soft parts: foot oval, elongated, smooth, light yellowish, sides a little brown, extreme edge thin, crenate (in alcohol). Thickened mantle-edge smooth, broad, very finely crenulate on extreme edge, with a single row of very fine white cilia; hood longer than in normal variety, very varicose; head prominent, light brownish, stout; muzzle stout, transversely rounded; fringe broad, striate, even, somewhat crumpled; disk radiately striate, bordered with a double row of granulose tubercles, the inner row most prominent; mouth subcircular, somewhat pointed below; tentacles as in normal variety. In most specimens, in alcohol, of this and other species, several impressed longitudinal lines may be noticed, perhaps due to the contraction caused by the preservative; gill moderate, rather longer and narrower than in normal variety; anal and infra-anal papillæ close together at the extreme right, less prominent, but otherwise as in variety *normalis.* Renal orifice minute, rounded, inconspicuous, midway between the gill on the left hand side and the anal tubercle on the right. Radula, as usual in the *Acmæidæ*, in two long double loops on the upper surface of the liver. Formula as in the last.

This variety, if it were not so closely connected by hybrids and intermediate forms with the other, would undoubtably rank as a distinct species. It is a northern form and the northern specimens are uniform and remarkably distinct from the southern *pintadina.* They become inextricably mingled, however, about Sitka, and puzzle the student beyond description. It seems as if several distinct local forms had spread, and at the points of meeting had hybridized until the hybrids and varieties equalled or outnumbered those which adhered to the original types; rather than that all had a common origin in one type. Further researches among the Aleutian Islands and on the east coast of Asia, are necessary, before we can trace the development of these forms with any satisfaction.

Var. *ochracea*, Dall. Plate 17, fig. 35.

There is another very well marked and pretty variety which I should refer to this species, and as it does not appear to have been described, I would propose for it the name of *ochracea;* externally it is of a very light yellowish brown, without spots or rays; internally white with the characteristic dark brown stain of *patina* in the visceral area. The exterior is covered with fine, regularly radiating, close, equal, thread-like riblets, which pass from apex to margin without bifurcation, imbrication or asperities of any kind. These riblets will serve to distinguish it from any of the other limpets of the coast; otherwise it approaches very close to some varieties of *scabra*, and can be traced right into varieties of *patina*. The variation of these limpets appears to be absolutely without limits; you may describe seven hundred forms as easily as seven. The only guide to specific identity is a certain habit of growth, easier seen than described, and very easy to overlook.

The home of the normal form may be said to be the Vancouver district, whence it extends northward to Cape Spencer, and southward to San Diego. The centre of radiation of the variety *Cumingii* is about Kadiák, whence it extends west and north to the Pribylof group in Bering Sea and the Aleutian chain, and south to Vancouver, straggling specimens even occurring about San Francisco. I have dredged it at six fathoms in Unga, North harbor, but they are usually found about tide marks.

COLLISELLA TESTUDINALIS, Mull. sp. Plate 14, fig. 13.

Patella testudinalis, Mull., Prodr. Zöol. Dan. p. 237, 1766.

Mantle with very fine papillæ around the edge which is colored in accordance with the margin of the shell, variable in different individuals. Tentacles long, slender, sharply pointed; eyes small on the upper posterior bases of the tentacles, which are rather swollen, with a strong tubercle on the inner side of each tentacle. Head large, rounded; muzzle short, with a wide thin puckered frill, not produced into lappets as in *Acmæa;* central disk granulose, mouth subcircular. Gill free all its length, situated in the commissure, between the mantle and neck on the left side, slender, elongate-triangular, pointing toward the right over the head, extensile beyond the edge of the mantle, whitish. Anal papilla obliquely truncate, situated close to the adductor on the right side, orifice internally papillose; infra-anal tubercle close, to the right of anal, minute, somewhat elongated. Renal orifice not detected, probably extremely minute, and to the left of the anal tubercle. Formula $\frac{0}{1(2+1\cdot1+2)1}$.

The minute uncinus is very hard to find and quite variable in form in this species. With care it may be detected, however. This species comes as far south, on the west coast, as Sitka. Here I found it, as well as the variety *alveus*, in great plenty, but of small size. It can pretty readily be distinguished from *C. patina* and, at Sitka, occupies a totally different station. There all the other limpets are found alive only in the vicinity of tide marks, but the *testudinalis* is to be found only in from six to fourteen fms. (south-west of the fish house on the point), on a weedy, gravelly bottom, overgrown with *Zostera* and *Laminaria*. Here all the conditions of ice cold water, stones for the normal form, and weeds for the variety *alveus* abound; while not another species is found in the vicinity except *Lepetidæ* and other deep water forms. Every gradation from the typical *alveus* to the typical *testudinalis* may be obtained. The animals, dentition and shells agree in every particular with those from Grand Manan (Stm.), New Bedford (J. H. Thomson), and Beverly, Mass. (Dall), with which I have compared them.

To the north it may be found in deep water among the Aleutian Islands. I obtained dead ones on the beach of St. George's (Pribyloff Ids) Bering Sea, and on Norton Sound and northward it is the only species. It is best known from the North Atlantic, where it abounds, but no specimens have been obtained, so far as I know, from the Arctic Sea between Lon. 75° and 160° E. of Greenwich. Some interesting facts in regard to migrations of this species are given by Forbes and others.

The position of the gill was not well understood by Williams and Jeffreys. It is situated on the left side of and above the head, and extends across to the right; most figures give an erroneous idea of its construction. The uncinus is very small, and sometimes abortive on some parts of the radula. I have clearly distinguished it, however, in many instances, and it can almost always be found with a high power.

COLLISELLA PERSONA, Esch. sp. Plate 14, fig. 8.

Acmæa persona, Esch., Zool. Atlas, v, p. 20, No. 9, pl. xxiv, f. 1 and 2. + *A. radiata*, Esch., ib. No. 8. + *A. ancylus*, Esch., ib. No. 10, pl. xxiv, f. 4—6. + *A. digitalis*, Esch., ib. No. 11, pl. xxiii, f. 7, 8.

Acmæa umbonata, Nutt., + *Oregona*, Nutt., + *textilis*, Gld.

Soft parts entirely cream color, except upper part of mantle edge. Foot oval, longer than the body, hiding the head; sides smooth; mantle edge narrow, thickened, upper surface with a few faint maculæ of color like the margin of the shell; smooth, finely ciliated. Head small, wide; tentacles short, thick, stout;

muzzle short, transversely oval; frill very narrow, granulose; disk radiately granulose; mouth semicircular; gill triangular, short, stout, small and wide. Anal papilla large, cylindrical; infra-anal smaller, bifid. Renal orifice to the left of anal tubercle very small, subcircular. Fæces expelled in sausage-shaped pellets. Formula, $\frac{0}{1(2--1\cdot1--2)1}$.

There is a small smooth variety of this species, with tesselated yellowish brown markings and a dark apex, which seems (without a connecting series) very far removed from the typical ribbed form.

The home of this species is in the Vancouver district. A very few were obtained at Sitka, and it may be considered pretty certain that Cape Spencer is its northern limit; it is plenty as far south as Monterey, and extends to San Diego. Habitat between tide marks.

COLLISELLA SPECTRUM, Rve. sp. Plate 14, fig. 10.

Patella spectrum, Rve., Conch. Icon. pl. xxix, f. 76 a, b.
Lottia scabra, Gld. (pars).

Soft parts: foot oval, sides whitish, smooth, darker toward the edge, sprinkled with black dots and streaks. Mantle whitish with dark patches, and irregular prolongations corresponding to the rays of color and ribs of the shell, edge smooth, ciliated. Gill small, short, triangular, thick, sharply pointed with a strongly crenate border on the left side; head small, anteriorly blackish, behind white; tentacles short, stout, pointed, tips blackish, bases nearly white; muzzle small, produced; disk striate; mouth rounded; frill granulose, narrow; hood rather large; renal orifice not detected; anal papilla small, conical, pointing to the right; infra-anal bifid, larger than and to the right of the anal tubercle. Formula as in the last.

This is a more southern species than most of those previously mentioned. The northern limit of its authentic habitat is Bodega Bay (Stearns), but it extends southward into Lower California, and is sufficiently common at Black Point, San Francisco Bay, and Monterey. It is a very sedentary species, invariably assuming the form of the rough crystalline surface of the rocks upon which it lives. It is also more confined in its station, keeping nearer low water mark than most of the other species.

COLLISELLA SCABRA, Rve. Plate 14, fig. 12, 12a.

Patella scabra, Rve., Conch. Icon. pl. xxxvii, f. 119 a, b, (not *scabra*, Gld.)

Soft parts: foot oval, sole light yellowish or ashy, sides almost

black; mantle with a narrow, brown, thickened border, with minute serrations corresponding to the striæ, and dots to the rays of color, of the shell; furnished with minute cilia on the extreme edge. Tentacles short, rather slender, almost black, tips under side and swollen base, whitish. Eyes very small, on outer bases of tentaculæ; head small, very dark slate color or blackish; muzzle short, dark; frill light yellowish white, crenate; disk dark, granulose, with a few papillæ on the upper anterior edge; mouth rounded. Gill very long, narrow and slender, attached to the under surface of the hood on the left side before the commissure of the neck and mantle; pointing toward the right. Anal papilla prominent, infra-anal smaller; renal orifice exceedingly minute, circular. Formula as in the last.

The color of this shell varies from almost black to light yellow brown; there is a variety of *patina* which closely approaches the dark variety.

It is also one of the more southern forms; two or three of the dark colored form were obtained at Victoria, Vancouver's Island, by Robert Kennicott. I have others from Port Orford, W. T. (Capt. E. E. Smith), and Stearns reports it from Bodega and Baulinas Bays. It is common near the heads of San Francisco Bay, and abundant at Monterey; yet in all these localities it is less plentiful than *C. pelta* or *patina*. It ranges southward to Lower California, and possibly to Mazatlan.

Collisella asmi, Midd. sp. Plate 14, fig. 7.

Patella asmi, Midd., Mal. Ross. ii, p. 39, No. 13, pl. 1, fig. 5.

Soft parts dark green. Mantle with a narrow thickened edge. Foot small, oval. Head very small. Formula, $\frac{0}{\frac{1}{2}(2-1\cdot1-2)\frac{1}{2}}$.

The above notes were taken from a dry specimen kindly communicated by Dr. Carpenter, from which the radula was obtained.

This species has long been a puzzle to conchologists. Most of them have regarded it as a variety, caused by a peculiar habitat, of some other species.* I am inclined to regard it as distinct, as the teeth show differences in detail from any of the other species. I have seen a few specimens of *pelta* and *patina* in which the apex was elevated, conical and black, which were supposed to be proof that *asmi* was only a form of one of them; but I confess I was unable to see that the malformed *pelta* or *patina* had anything more than a slight resemblance to

* Mr. Jeffreys suggests (Brit. Conch. iii, p. 249) that it is a variety of *Acmæa virginea*, but it has hardly a character in common with it.

C. asmi, and none of the specimens alluded to approached the latter in solidity, were as roundly conical, or were as smooth as the typical *asmi*. Very perfect specimens of the latter show under a strong magnifier exceedingly fine, close grooves, which are usually invisible to the naked eye, and are different from the sculpture of either *pelta* or *patina*. Mr. Stearns found numbers of specimens attached to *Chlorostoma funebrale*, and it has not been found alive anywhere else. Its range, as far as known, is from Sitka to Santa Barbara Island, and it is rare everywhere, but perhaps most common at Monterey.

COLLISELLA MITELLA, Mke. sp. Plate 14, fig. 9.

Acmæa mitella, Mke., Zeitschr. f. Mal. 1847, p. 187, No. 43.
Patella navicula, Rve., Conch. Ic. pl. 40, f. 130 a, b. 1854.

The dentition of this species was obtained from a very small dry specimen. Dr. Carpenter describes the shell, (Maz. Cat. p. 210). It has, as far as I am able to discover, been reported only from Mazatlan and the Gulf of California.

COLLISELLA STRIGATELLA, Cpr. sp. Plate 14, fig. 5.

Acmæa strigatella, Cpr., Ann. and Mag. N. Hist. 3d ser. xiii, 1864, p. 474.
A. strigillata, Cpr., Sup. Rep. 1863, p. 618, No. 17.

The dentition of this species was also worked out from a small dry specimen, which afforded no details in regard to the animal. It is reported from Cape St. Lucas, where it was collected by Xantus.

COLLISELLA FASCICULARIS, Mke. sp. Plate 14, fig. 11.

Acmæa fascicularis, Mke., Zeitschr. f. Mal. 1851, p. 38, No. 134.
Patella opea, Rve., + *A. mutabilis*, Mke. (pars).

A similar remark will apply to this species. It has been obtained from Cape St. Lucas, Margarita Bay, Mazatlan, and the Gulf of California generally. In this species and *C. mitella* the specimens from which the teeth were obtained were so very minute that the accessory uncinus could not be clearly made out, and hence is omitted in the figure. An examination of the adult radula would doubtless disclose them, as in the allied species.

COLLISELLA PALEACEA, Gld. sp.

Acmæa paleacea, Gld., Mex. and Cal. Shells, p. 3, pl. 14, fig. 5. Cpr., P. Z. S. 1856, No, 40.

Some specimens of the animal of this species, which I owe to

the kindness of Mr. R. E. C. Stearns, came too late to be figured, but the radula, as I suspected, is that of a typical *Collisella*. The uncinus is straight, slender and exceedingly small. The animal appears to have been pellucid, with a black spot on the front of the head. The tentacles are rather short, the eyes very black and large, and the mantle edge smooth. The whole creature is extremely compressed laterally, from its habitat.

Collected at Monterey, Santa Barbara and San Diego.

COLLISELLA (?) DEPICTA, Hinds.

Patelloida depicta, Hinds, An. N. Hist. x, 1842, p. 82, pl. vi, fig. 4.

This species and the last are certainly very different from the true *Nacellæ*, and should not be referred to that genus. They owe their elongated and compressed form to their restricted habitat (on a Zostera-frond), but, unlike *C. alveus*, cannot be referred to any species now known, of the usual oval form. It is probable that this species also will be found to belong to this genus. It is quite likely that thorough dredging would result in procuring non-compressed specimens, which might have grown on pebbles, &c., as in the case of *C. testudinalis*, var. *alveus* (Couth.), which I obtained of all forms at Sitka, and also the next species. Habitat from Santa Barbara to San Diego.

COLLISELLA (?) TRIANGULARIS, Cpr.

Nacella (*? paleacea* var.) *triangularis*, Cpr., Proc. Cal. Ac. Sci. iii, p. 213, 1866.

Compare *Patella pygmæa*, Dunker, Moll. Jap. p. 24, pl. iii, f. 20, 1861.

The soft parts of a single live specimen, examined at Monterey, appeared to resemble the other species of this genus; unfortunately, it was afterwards lost, and the opportunity of examining the dentition with it. Some twenty specimens were obtained at the same locality. These were exceedingly interesting, as they presented every variation in form, from wide, oval and nearly flat, to narrow, triangular, high and very compressed. The extreme apex is almost always black. It is usually furnished with a few dark brown stripes, radiating from near the apex but seldom reaching the margin in adult specimens; these, however, are wanting in some specimens. In all its forms it is a well marked species, and, while resembling Dunker's species, cannot be united with any now known from the California coast. It is known from Monterey and Baulinas Bay; I obtained a single dead specimen at Sitka. Dr. Carpenter proposes to rename this form specifically "*casta*" and to apply the term "*tri-*

angularis" to the compressed variety only; it is doubtful, however, if such a course would be admissible, as every transition in form can be observed in a very few specimens.

COLLISELLA ATRATA, Cpr. Plate 14, fig. 15, 15a.

Acmæa (? var.) *atrata*, Cpr., An. Nat. Hist. 3d ser. xiii, p. 474, 1864.

Mantle edge nearly smooth, narrow; head small; tentacles very short and stout; gill small, broad and short; muzzle small, somewhat produced. General hue yellowish. Intermediate between *discors*, Phil., and *floccata*, Rve. (Cpr. loc. cit.), all being probable varieties of one species. Cape St. Lucas, Acapulco.

COLLISELLA PEDICULUS, Phil. Plate 15, fig. 16.

Patella pediculus, Phil., Zeitschr. für Mal. 1846, p. 21, No. 8. Cpr., Maz. Cat. p. 200, No. 260.
Patella corrugata, Rve., Conch. Icon. pl. 40, f. 132.

Animal small in proportion to the size of the shell; mantle margin nearly smooth, puckered to fit the angles of the ribs; head small, short; muzzle moderate; tentacles very short, stout, pointed. Gill wider than long, triangular, short; hood large and produced.

It was with some surprise that I observed the well marked gill on the neck of this species, as the shell characters were essentially those which have been usually regarded as patelloid. But the present case and that of many other species, afford good evidence of the worthlessness of the shell characters in this group as indications of affinity.

The young of this species is indistinguishable from "*Patella*" *discors*, jun. In the adult *discors*, however, the ribs become evanescent and usually disappear entirely. The sculpture is identical in both, barring the ribs, as is the apex in most cases. Still the aspect of the adult is generally sufficiently distinct to be readily recognizable, so that we can well afford, in the absence of any knowledge of the animal of *discors*, to consider the two forms distinct. The shells of *pediculus*, according to Dr. Carpenter, are much like young *Ancistromesus Mexicanus;* the animals, however, belong in different families. The habitat of the present species is on the Mexican coast from Acapulco to Mazatlan.

COLLISELLA SUBRUGOSA, D'Orb. Plate 14, fig. 14.

Acmæa subrugosa, D'Orb., Voy. Amer. Merid. vol. v, p. 479, No. 442, 1847.

Lottia onychina, Gld., Moll. U. S. Ex. Ex. p. 355, fig. 461, 461a, and b, 1852.

Animal yellowish; mantle greenish, with brown markings upon the border, ciliated; head and tentacles rosy. Hab. Rio Janeiro, Brazil.

The soft parts of this unpretending little shell agree in all essential particulars with the west coast species.

COLLISELLA (?) ROSACEA, Cpr.

Acmæa (? pileolus var.) *rosacea*, Cpr., Proc. Cal. Acad. Sci. iii, p. 213, 1866.

Common at Monterey (50 sp. Dall), and reported from San Diego.

The type specimen of this species is now before me. After a careful study of it, I would add to Dr. Carpenter's diagnosis the following remarks:

The shell is small, obtusely conical with an erect, subcentral apex. The ground color of the surface is a translucent white, suffused with rose toward the margin, where several indistinct rays of rose color appear. These are more evident on the inside. The extreme nucleus is usually white. The apex is profusely dotted with minute dark brown and opaque white specks of color, which are not rays, nor are they often arranged with any regularity; these are more numerous on the posterior portion of the shell, but vary exceedingly, from a dark reticulated brown network of lines to wavy irregular pencillings or sparse brown dots, usually most plenty on the interspaces of the ribs. The surface is smooth, especially in front, but from the apex radiate (especially on the posterior half of the shell) a number of very marked riblets which appear as if indented from below, and do not materially interrupt the smoothness of the surface, though the margin is rendered slightly crenulate by them. They are also of a more opaque white than the remainder of the shell, and sometimes form conspicuous white rays.

This species is a southern form and has not been found north of Monterey as far as recorded. It is somewhat confused, on account of having been confounded with small dead specimens of *Liriola peltoides*, (Cpr.) Dall, which have a general resemblance to it in form and color, though otherwise very distinct.

The latter much more nearly resembles *Acmæa virginea* than does the true *rosacea*, which is a very different shell.

On comparison, we find that *rosacea* wants entirely the characteristic brown rays of *virginea*, the apex of *rosacea* is much

more central, blunt and erect; the shell is less convex, polished and delicate, though smaller than *virginea;* and if the two were found in the same locality they would both be recognized by most conchologists as distinct species. A shell which is more nearly allied to, though very distinct from, *rosacea,* is *Patella punctuata*, (Lam.) Rve., Icon. No. 122, from Honduras and Aspinwall. Still closer is *Acmæa* (*Collisella?*) *æqualis*, Cpr. MSS. from the Gulf, yet it seems to be distinct, from the single dead specimen known to me.

I have doubts as to the genus of this species, which may be a patellid.

"*Acmæa pileolus*," Midd., I believe to be a variety of *pelta*, as Dr. Carpenter suggests; at all events the figure and diagnosis do not give any characters common to this or any other of the southern species. Dr. Carpenter says that the types (in Mus. Cuming) of Middendorf's species are *rosacea*, yet I believe with him, that some mistake has certainly occurred; as *rosacea* is not to be found at Sitka, the locality of *pileolus*, and the description and figures cannot be reconciled.

This name of Middendorf's had better be dropped entirely, as it is impossible to determine, with certainty, what his shell was, and its retention can only create confusion.

Collisella araucana, D'Orb.

Patella araucana, D'Orb., Voy. Am. Mer. v, p. 482, No. 448, ix, pl. lxv, fig. 4—6.

The animal of this variable species is brownish, and agrees in every essential particular with the other known species of this section. The uncinus is short and somewhat notched or bifid at the extremity. The specimen examined came from the Chilian coast near Valparaiso.

Collisella (?) sybaritica, n. sp. Plate 17, fig. 34.

Shell depressed, thin; apex subcentral, more anterior in the young. General shape rounded oval, hardly more narrow before than behind. Surface nearly smooth, with rounded concentric lines of growth; in young specimens a few faint, hardly noticeable elevated radiating lines or riblets may be observed near the margin, which is entire. Internally smooth, border polished and also the cavity of the apex above the muscular impressions. Color a clear rose pink, varying from quite deep and a little livid in some specimens, especially the young, to a very faint pink. Apex white, even in very young specimens entirely uneroded, rather blunt and inconspicuous; sides of the shell ornamented with rays of a darker shade of pink, more or less gathered in groups, and

more or less evident, according to the shade of the remainder of the shell. Internally, the visceral area is bluish white, usually washed with a faint yellowish brown, often hardly evident; in which case the area is whitish; the successive layers of brown sometimes appear externally around the apex when eroded. The inner margin, and to some extent the whole interior, exhibit the external markings or rays, through the somewhat pellucid shell. Texture hard and brittle. Epidermis exceedingly thin, usually evanescent; translucent brownish. Soft parts unknown.

Long. of largest specimen ·6 in. Lat., 1·46 in. Elevation, ·2 in.

This is a deep water species, at least in Bering Sea. I found an abundance of beach specimens at St. George's Island, of the Pribyloff group. Capt. E. E. Smith obtained two specimens on the beach of False Pass, Aliaska Peninsula, near Mt. Isanotsky. Dr. Carpenter writes that he had obtained young individuals, probably of this species, from Japan.

The pattern of coloration is entirely different from *Collisella (?) rosacea*, Cpr., both inside and outside; it is more depressed, and grows much larger than that species, which is subtropical, while this is sub-boreal. From *Acmæa virginea*, Mull., it differs in form, texture, color and pattern of coloration. I know of no other species with which it can be compared.

Cab. Dall, Carpenter, Smithsonian Institution, and Academy of Natural Sciences, Philadelphia.

Acmæa (?Collisella) hieroglyphica, n. s. Plate 17, fig. 37.

Shell small, stout, rugged, with a subcentral, more or less eroded, apex; moderately elevated. Muscular impression pyriform, shape of shell ovate; exterior with rather strong white ribs, 14—20 in number, with riblets between them; interspaces brown. Striæ of growth somewhat imbricated, less prominent on the ribs. Internally white, with brown maculæ on the margin corresponding to the brown interspaces of the exterior. Margin strongly crenulated. Spectrum pyriform, with the smaller end anterior, consisting of a sharp black line forming a pyriform figure, with three longitudinal black lines inside of it. In the larger specimen these have a faint bluish halo about them, but in the smaller they are simply black on a white ground. The same figure of less size is conspicuous on the outside of the eroded apex. Soft parts unknown. Lon. ·4, lat. ·3 in.

Hab. China. Cab. Dall and Acad. Nat. Sciences of Phila.

This very peculiar and characteristic little shell was found in one of those boxes of Chinese shells sold in the tea-shops of San

Francisco. It is unlike any species figured or described in the works at my command, and I know of no species with which it might be compared. It belongs to the same group as *C. spectrum*, Reeve, as far as the shell goes, but resembles it very slightly. The peculiar spectrum resembles a Chinese character or hieroglyphic, from which I have taken the specific name.

Section B ; with two uncini. (*? Collisellina*).

COLLISELLA SACCHARINA, Linné. Plate 15, fig. 18.

Patella saccharina, Lin., Syst. Nat. Ed. xii, p. 1258. Ed. Gmel. p. 3695. Lam., An. sans Vert. Ed. Desh. p. 527, No. 7. Adams, Chenu, &c.

Astrolepas, Argenville, Conch. t. 2, fig. M.

Acmæa saccharina, Hanley, Wood's Ind. Test. 2d ed. 1856, p. 185, No. 17.

Patella lanx, Rve., Conch. Icon. pl. xxx, f. 82, 1855.

? Patelloida stellaris, Quoy and Gaim. (non Rve).

Mantle edge smooth, narrow, puckered to fit the ribs of the shell. Head small; muzzle short; tentacles very small, rapidly tapering to a very sharp point; hood much produced; gill stout, moderately large, broad and pointed; foot oval, thin. Colors yellowish; sides of foot dark, muzzle blackish, back of head and tentacles nearly white, mantle edge with a mottled dark border. Formula, $\frac{0}{2(2-1\cdot1-2)2}$.

Hab. Indo-Pacific, Amboyna, Japan.

My surprise was great when I found this well-known species, which is tabulated as a "*Patella*" by the most recent authors, to belong to the Acmæidæ; but it was still further increased when, accidentally referring to that excellent and very accurate work, Hanley's edition of the *Index Testaceologicus*, I found that Mr. Hanley had anticipated me in the discovery, and it was there referred to the genus *Acmæa*.

This and the following species exhibit a peculiarity worthy of notice, in the duplication of the uncinus. For a long time I thought that my eyes were deceived, and that there was but one, which was folded or twisted so as to give the effect of a double cusp, but I found the uncini separated, and lying side by side, after handling the radula, so that I could no longer doubt it.

COLLISELLA BORNEENSIS, Rve. Plate 15, fig. 17, and pl. 17, fig. 38, a, b, c.

Patella Borneënsis, Reeve, Conch. Icon. pl. xxxvi, f. 113, a, b. (bad). Identified from specimens. Borneo.

Acmæa Bickmorei, Dall, MSS. Amboyna.

Mantle edge thick, with a single row of rather stout papillæ interspersed with smaller ones irregularly disposed; sides of foot smooth; foot oval, thin, rather small; muzzle and edges of foot dusky; back of head, bases of tentacles and mantle edge yellowish. Head stout, short, rounded; tentacles short, small, rapidly tapering to a sharp point; in the alcoholic specimens invariably hooked, or with the tips recurved. Muzzle rather transverse, surface radiately papillose, frill conspicuous, smooth and even. Gill very large and long, usually protruded across the neck nearly to the mantle edge. Anal and infra-anal apertures on a prominent pointed tubercle; renal not observed. Uncini larger than usual. Formula, $\frac{0}{2(2-1\cdot1-2)2}$.

This species was obtained it abundance at Amboyna, by Mr. Bickmore.

The muscles which retract the radula are transversely striated. See Silliman's Am. Journ. Sci. and Arts, Feb., 1871, p. 123. Since that time a similar state of things has been observed in *Collisella palcacea*, Gld. These are the first instances of such fiber noticed in the class *Gasteropoda*.

Genus LOTTIA, Cpr. ex Sby.

Lottia (Gray MSS.), Sby., Gen. Shell, part 42, fig. 1. Reeve, Conch. Syst. f. 1, 1842.

Tecturella, Cpr., Smithsonian Check List, W. C. Shells, 1860, p. 3, No. 176. Rep. Br. Assoc. 1861, p. 137.

Tecturina, Cpr., Smiths. Rep. 1860, p. 219. Lect. Moll. Ind. Ed. p. 71 = err. typog. for *Tecturella?*

Lecania, Cpr. MSS.

Lottia, Cpr., Journ. de Conchyl. vol. xiii, p. 140, 1865. Am. Journ. Conch. vol. ii, p. 342, 1866. Sup. Rep. Brit. Assoc. 1863, p. 650, No. 249.

Animal with a single cervical branchia; also furnished with a branchial cordon of laminæ between the mantle edge and the foot, extending as far forward as the adductor muscle on each side, and continuous behind. Teeth and muzzle frill as in *Collisella*. $\frac{0}{1(2-1\cdot1-2)1}$.

Type LOTTIA GIGANTEA. Plate 15, fig. 20.

Lottia gigantea, Sby. *apud* Gray. Gen. Sh. pt. 42, f. 1.
Acmæa scutum, auct. non Esch. nec D'Orb.
Tecturella grandis (Gray) Cpr.

The shell of this species has been fully described by Dr. Carpenter in his admirable paper on the Acmæidæ, before cited; it only remains to give a few additional notes on the animal. I

obtained more than a hundred specimens on the rocks, between tides, at Monterey, California, in the month of January, 1866. At this time they were well filled with ova, and all the specimens obtained contained ova; not a single male came to hand.

The foot is oval, thin, dull waxen below; sides of foot smooth, black, the extreme edge pellucid white or yellowish; the whole nearly as long as the shell. Mantle thin, extending little beyond the foot on the sides, but some distance beyond the head in front; edge thickened, smooth, whitish, with a crowded row of fine blackish papillæ on the extreme edge; another of larger and more distant papillæ inside; and lastly a row of still larger ones inside of the last, placed opposite the spaces between the papillæ of the second row, and somewhat further apart. The branchial lamellæ exactly resemble those of *Patella vulgata*, as described by Dr. Williams, but are somewhat less crowded and of a pellucid wax color. They are equal on the sides and behind, but diminish in size on each side of the head, and are interrupted in front for a space as wide as the head. The gill is elongate-triangular, quite large, attached by both edges for a short distance to the mantle above it, forming a shallow bag-shaped cavity; it is curved a little to the right and is inserted to the left of the neck, in the commissure between the neck and the mantle. In structure it is a flat plate, with rounded, striated edges, bounded by an impressed line, which is stronger on the under side. Inside of this line, above and below, extend a series of equal tranverse laminæ, less strongly marked toward the apex of the gill, which is smooth and produced at the tip. A nerve and blood-vessel pass along the left edge of the gill; the laminæ are hollow and profusely furnished with blood-vessels. The hood above the gill is also extremely vascular.

On the right side of the neck is a smooth subcylindrical anal papilla, obliquely truncate, so that the foramen opens toward the right side of the animal. From the foramen project forty or fifty long, slender, cylindrical, white papillæ or tentaculate processes, but they originate inside of the edge of the aperture, which is entire and closed by a subspherical process of the integument. The renal organ opens to the left, outside of this papilla, through a very minute non-elevated orifice, in which it differs from *Patella vulgata*. To the right of the anal papilla is a rounded tubercle, with a semilunar orifice. There are no other papillæ or tubercles in the vicinity, nor could any "capitopedal orifices" be detected as described in *Patella* by Lankester. The head and tentacles are whitish below and black above, but the black color does not extend behind a line drawn from the

inner corner of one tentacle to the other. Behind that line both head and tentacles are whitish.

The tentacles are short, stout, acutely pointed, and somewhat granulose. The eyes are very small on the outer edges of the tentacles, which have a prominent tubercle on the inner edge of each.

The muzzle is short, stout, and transversely oval. Its outer edge is somewhat striate and produced into a frill. Inside of this, around the circular mouth, the disk is granulose and deeply radiately furrowed. Just inside the mouth, the edge of the jaw is perceptible, and arches over the lateral lips of the buccal mass.

The viscera are small in proportion to the size of the animal. The ova were of a greenish color. The renal organ extended over a fourth of the area of the back between the muscles.

The range of this species is from the vicinity of San Francisco to Central America. It is especially abundant and fine at Monterey. Some of the specimens which I obtained there were nearly three inches long. Put into a pitcher half full of sea water, with a number of other mollusks, the majority of this species crawled out during the night and were found on the outside of the pitcher, and even on the wooden floor, in the morning.

Genus SCURRIA, Gray.

Scurria, Gray, P. Z. S. 1847, p. 158. Guide, Moll. p. 171. Chenu, Man. de Conchyl. i, p. 375.

< *Scurria*, Möerch, Cat. Yoldi, p. 145, 1852. Cpr., Lect. p. 71. H. and A. Ad., Gen. Rec. Moll. i, p. 460.

< *Acmæa*, Woodw., Man. p. 155.

Scurra, Gld., Expl. Exp. Moll. p. 357, *non* Esch.

Acmæa, sp. D'Orb., Voy. Am. Merid, v, p. 478, 1846.

Helcion, sp. ib., p. 703 !

Lottia, sp. ib., pl. 64, vol. ix ! !

Not *Scurria*, Cpr., Am. Journ. Conch. ii, p. 345 = *Acmæa* sp.

Animal with an accessory branchial cordon extending entirely around the body between the mantle and the foot. Teeth resembling *Collisella* A. Formula $\frac{0}{1\,(2-1\cdot 1-2)\,1}$.

In this genus the cordon is complete as in *Patella*, while the dentition and branchial plume show its true place to be in the *Acmæidæ*. There does not appear to be any grounds for the distinction drawn by Dr. Gray between the cordon in this genus and that of other *Patellæ*. In *Scurria mesoleuca* they are absolutely identical in form and arrangement with those of *Lottia*, excepting that they are not interrupted in front as in that genus.

Type SCURRIA SCURRA, Lesson sp.

Patella scurra, Lesson, Voy. Coq. Zool. p. 421, No. 189, 1830.
Acmæa scurra, D'Orb., Voy. Amer. Merid. v, p. 478, pl. lxiv, fig. 11—14.
Scurria scurra, Gray, P. Z. S. 1847, p. 158. Guide Moll. p. 171. Chenu, Man. de Conchyl. i, p. 375, fig. 2812. H. and A. Ad., Gen. Rec. Moll. i, p. 460, iii, pl. lii, fig. 4, a, b.
Lottia pallida, Sby., Moll. Beechey's Voy. p. 147, pl. xxxix, f. 1, 1839. Not *Patella pallida*, Gould.
Lottia conica, Gld., Moll. U. S. Expl. Exp. p. 346, (pars).
Not *Acmæa mitra*, Esch., (Zool. Atlas, ed. Rathke v, p. 18,) as aver Gray and Adams.
Acmæa mitra, Alcock, (MSS.), in Am. J. Conch. ii, p. 345 not Eschscholtz.
Lottia scurra ? Gld., Expl. Exp. Moll. p. 356.

Soft parts yellowish white for the most part; foot large, subovaL, smooth; mantle edge thickened, smooth, finely fringed with short marginal cirri; head very large, of a rosy tint; muzzle short, frilled; tentacles large and slender, faintly roseate, with very minute black eyes at their lateral and posterior bases. Branchial lamellæ resembling those of *Patella*, but rather more distant, erectile; gill very stout, thick, with a rather broad border formed by an impressed line on each side; lamellæ prominent, apex pointed.

Shell buff, outer layer of a waxen translucency, inner layer porcellanous white, with narrow margin resembling the external layer. Form conical; apex usually minute, sharply pointed, anteriorly directed, (not blunt and erect, as in *Acmæa mitra*); anterior and posterior slopes convex (seldom or never concave, as is frequent in *A. mitra*); aperture roundly oval, slightly narrower in front, external surface covered with fine, regular, even striæ, like threads radiating from the apex (very different from the rough, irregular, bifurcating riblets of the varieties of *A. mitra*); internal surface of a peculiarly glossy white, scored with more or less strongly marked radiations from the apex; margin obsoletely crenulate inside; apex often white, but not uncommonly marked with brown streaks on a white ground, radiating from a dark brown nucleus and divaricating; apex of this young fry strongly recurved, nearly marginal, without any trace of a spiral nucleus. The concentric lines of growth are more or less strongly marked but usually rounded and obsolete.

Habitat from 12° to 41° s. lat. on the west coast of South America. It lives on the roots and stalks of fuci (*Macrocystis*),

and excavates a shallow cavity therein. According to D'Orbigny, it is not uncommon.

I have not been able to examine the soft parts of this species and rely on Gould, Couthouy and D'Orbigny.

SCURRIA (?) ZEBRINA, Lesson sp.

Patella zebrina, Less., Zool. Coq. 1830, p. 417, No. 180.
Patella concepcionensis, Less., loc. cit. p. 418, No. 182.
Lottia zebrina, Gld., Moll. Expl. Exp. p. 352, pl. 30, fig. 460, 460a.
Lottia variabilis, Gray, Moll. Beechey's Voy. p. 147, pl. 39, fig. 3—5, 1839.
Patella zebrina, D'Orb., Voy. Amer. Merid. v, p. 480, No. 445, pl. lxv, f. 1—3.
Tectura zebrina, Gray, Guide p. 171.

D'Orbigny describes and figures this species as having a complete cordon of strongly marked branchial lamellæ; Couthouy speaks of "an encircling series of slight protuberances, which appear to communicate with the cirri, and at first look like branchial lamellæ; at times very apparent, at others hardly visible," while calling attention to the long and large gill. Gray speaks of them as "fleshy beards" inside of the mantle, rather distant and continuous over the head. On the whole, the evidence is sufficiently full to justify us in placing the species in this genus, at least provisionally.

SCURRIA MESOLEUCA, Mke. sp. Plate 15, fig. 19.

Acmæa mesoleuca, Menke, Zeit. für Mal. p. 38, No. 135, 1851. Cpr., Maz. Cat. p. 203, No. 263.

Soft parts mostly of a greenish tinge; foot oval, thin, smooth; sides of foot quite smooth, edge thin, somewhat produced; mantle edge thickened, narrow, marked with dark brownish spots or streaks corresponding with the rays of color on the shell, irregularly bearded with a few papillose projections. Branchial lamellæ forming a complete cordon just inside of the mantle edge. Laminæ close, crowded, equal all around, in structure exactly agreeing with those of *Patella* and *Lottia*, a little more puckered at the edges, perhaps from the effects of the alcohol. Head small; muzzle short, transversely oval, with an equal, narrow, somewhat puckered frill all around. Disk radiately striate, mouth circular, entire. Tentacles very short, stout, bluntly pointed; bases slightly swelled, not tuberculate; eyes small, on the superior part of the bases of the tentacles. Gill like that of *Lottia*, but smaller, shorter, and relatively

broader. Anal papilla small, resembling that of *Lottia;* infra-anal papilla broader, bifid; renal orifice small, subcircular, not elevated, some distance to the left of the anal. Formula $\frac{0}{1\,(2-1\cdot 1-2)\,1}$.

The shell has been well described by Menke and by Dr. Carpenter in the Mazatlan Catalogue, with copious synonymy. From the latter, however, *Acmæa personoides*, Mid., should be eliminated, as it came from Cook's Inlet where *S. mesoleuca* is unknown. The former is probably only a variety of *patina*.

The range of this species is from Central America to Lower California. It is plenty in the Gulf, and I collected several hundred specimens at San Juan del Sud in Nicaragua, in the course of half an hour. It inhabits the rocks between tide marks.

Family PATELLIDÆ.

Patellina, McGillivray, Moll. Aberdeen p. 66, 1843.

< *Patellidæ*, Woodw., Man. p. 153. Cpr., Rep. Br. Assoc. 1856, p. 318. Jeffreys Brit. Conch. iii, p. 229 (in *Pectinibranchiata !*) Binn. Inv., Mass. Ed. ii, p. 267. D'Orb., Moll. Can. 1837.

< *Patelloidea*, Risso, Hist. iv, p. 260, 1826. (Not Fer., Rang or Mke.)

< *Patellina*, Wiegm., Handb. der Zool. p. 546, 1832. Milne-Edwards, Conch. Textb. Ed. vi, p. 197.

< *Patellæ*, Fer., Tab. Syst. p. xxxvii, 1821. Rang, Man. p. 251, 1829. Desh., Enc. Meth. iii, 1830.

< *Patellacea*, Mke., Syn. Ed. ii, p. 90, 1830. Forbes, Mal. Monensis, p. 35, 1838.

< *Patellaceæ*, Menke, Syn. 1828, olim. Hinds, Voy. Sulph. Zool. p. 53.

< *Patelladæ*, Guild., Zool. Journ. iii, p. 535, 1828.

< *Phyllidiana*, Lam., Phil. Zool. 1809. Gld., Inv. Mass. Ed. i, p. 146.

> *Patellidæ*, Gray, Guide Moll. p. 173. Chenu, Man. de Conchyl. i, p. 376.

Patellidæ, Cpr., Maz. Shells, p. 199. H. and A. Ad., Gen. Rec. Moll. i, p. 463. Cpr., Sm. Rep. 1860, p. 219. Lect., Moll. 2d ed. p. 71. D'Orb., Voy. Am. Mer. v, p. 480, 1842.

Animal destitute of a cervical branchia but provided with a more or less complete cordon of branchiæ in the form of laminæ attached to the mantle between its thickened edge and the sides of the foot. Radula provided with three lateral teeth on each

side and three uncini. Rhachidian tooth rarely present. Muzzle without a frill.

Genus ANCISTROMESUS,* Dall.

Patella sp., Auct.

Animal with a complete branchial cordon, the lamellæ long and slender, subequal; sides of foot smooth; radula furnished with a simple rhachidian tooth; the two inner laterals on each side anterior to the third pair, which are large and quadridentate. Uncini simple. Shell very large in the adult.

Type ANCISTROMESUS MEXICANUS, Dall ex Brod. Pl. 15, fig. 21.

Patella mexicana, Brod. and Sby., Zool. Journ. vol. iv, p. 369. Rve., Conch. Icon. *Patella*, pl. i, f. 1.

Animal generally blackish, more or less marbled and streaked with white. Head, mantle edge and branchial lamellæ black. Head very long, not large in proportion; muzzle small. Tentacles short, slender, pointed. Branchial lamellæ not semicircular, as in most Patellæ, but produced, twisted, and elongated, having, upon a superficial examination, an arborescent appearance. They are very slightly smaller in front. Radula with a well developed median tooth. Cusps of the teeth fawn color, with chestnut brown bosses and an orange ring at the point of insertion of the cusp. Formula, $\frac{1}{3(1_4-2\cdot2-1_4)3}$.

Shell white, inside and out, sometimes with a rusty or greenish stain here and there, and furnished with obsolete radiating ribs. Often attaining a length of from eight to fourteen inches.

This magnificent limpet, the largest non-spiral gasteropod now living, proved, as might have been anticipated, to differ essentially from its smaller cousins. It is found in Central America. The radula figured was from an Acapulco specimen. It is somewhat singular that the animal of a nearly white shell should be almost black, especially as the shell is an external one. I have seen the latter frequently used as a wash-basin, in Central America.

Genus PATELLA, Linné.

Patella, Auct. omn. binom. *P. vulgata*, type.

Patella, Lam., Prodr. 1799. *P. granularis*, type. Syst. An. s. Vert. ed. 1801. *P. testudinaria*, type.

< *Patella*, Lin., Syst. Nat. 1758, ed. x. H. and A. Ad., Gen. Rec. Moll. i, p. 464. Cpr., Lect. Moll. p. 71. Gray, Guide, p. 174. P. Z. S. 1847, p. 168. Woodw., Man. p. 154. Schum., Essai, 1817.

* From Αγκιστρον, a hook or claw, and Μεσηγὺς, middle.

Scutellastra, H. and A. Ad., Gen. Rec. Moll. i, p. 466. Chenu, Man. de Conchyl. i, p. 377.

Cymbula, H. and A. Ad., Gen. Rec. Moll. i, p. 466, 1854. Chenu, Man. de Conchyl. i, p. 378.

Olana (?), H. and A. Ad., Gen. Rec. Moll. i, p. 466. (*P. cochlear*, Gmel., type.) Chenu, Man. de Conchyl. i, p. 378. Gray, Guide, p. 175. Cpr., Lect. Moll. p. 72.

Eruca, Tournefort, Gualteri, Index, 1742 (not Swains.)

< *Patellites* sp., Walch., Naturg. d. Verst. ii, p. 168, 1768. Schröt., Naturförs. v, p. 102, 1775. Waller, Syst. Min. ii, p. 468. Schröt., Lith. Lex. v, p. 112. Schloth., Petrefactenkunde, p. 113, 1820 (= *Patella*, fossil sp.)

< *Patellaria*, Llhwyd, 1698. Schröt., Lith. Lex. v, p. 112.

? *Goniclis*, Rafinesque, Journ. de Phys. 1819, t. 88, p. 426. Mke., Syn. Ed. ii, p. 90 (not *Goniclis*, Raf., Sup. Mon. Biv. Phila. 1831).

Lepas sp., Adanson, Voy. Sen. 1757.

Lepadites sp., D'Argenville, &c. (foss. sp.)

Patellus, Mont., Conch. Syst. ii, p, 66, 1810.

Lottia sp., Gray, fide D'Orbigny, Voy. Am. Mer.

? *Patellarius*, Dum.

? *Cellana*, H. Adams, P. Z. S. 1869, p. 274.*

If we take as the type that which (according to the rule adopted by Linnæus) was the most common species known to him, we shall undoubtedly select the *Patella vulgata*, of the northern European seas. The type most commonly cited is that of Lamarck, in 1801 (*P. testudinaria*), but his first type and only species mentioned in 1799 was the *P. granularis*. The former, however, is probably an *Acmæa*. There are two very distinct types of dentition among the true Patellæ, and one of them must be separated by name. As objections might be raised to proposing a new generic name for *Patella vulgata*,† from which I suspect *Patella granularis* may differ considerably, I shall regard the former as the type of the genus, and the position of the latter species will remain to be fixed whenever the animal shall have been examined.

Animal with a complete, uninterrupted branchial cordon between the mantle and the foot; destitute of side lappets on the foot; radula with the first two inner laterals on each side similar, in the same transverse line, parallel; third lateral largest,

* The diagnosis includes no characters of more than specific value. The true place of the species can only be determined when the animal is known.

† I am indebted to Dr. Wm. Stimpson for the opportunity of examining the soft parts of this species.

denticulate, posterior; uncini distinct, similar, three on each side. Formula, $\frac{0}{3(1-2\cdot2-1)3}$.

Type PATELLA VULGATA, Lin. Plate 15, fig. 23.

Patella vulgata, Linné, Syst. Nat. Ed. 12, p. 1258. Forbes and Hanley, Brit. Moll. ii, p. 421. Jeffreys, Brit. Conch. iii, p. 236.

Soft parts: foot slate colored, sides smooth, yellowish, somewhat dusky with a pale border; mantle yellowish, edge thickened, furnished with tentacular filaments, varying in length and corresponding in position to the ribs and striæ of the shell, extreme edge sometimes dusky; branchial cordon uninterrupted, laminæ rather smaller in front of the head, of a pellucid yellowish color; head short, stout; tentacles moderate, pointed, yellowish, darker at the tips; muzzle indented below, bordered with granulose papillæ, especially below; disk radiately striate; eyes small, on superior bases of the tentacles; not raised above the swollen base, which has a prominent tubercle on the inner edge; anal orifice on the right side at the junction of the mantle with the neck, prominent, inclined to the right, but not obliquely truncate as in some species, orifice rounded, internally papillose; renal orifice on a small yellowish tubercle to the left of the anal; infra-anal papilla similar, inconspicuous, to the extreme right. Formula, $\frac{0}{3(1/3-2\cdot2-1/3)3}$.

Habitat. British and North European seas from the Loffoden Isles to the Mediterranean.

The minute anatomy of this species still stands in need of much elucidation; and, as one of the best known species of the order, a synopsis of what is known and what is undetermined will give a good idea of the extent of our knowledge of the anatomy of the group.

It does not speak well for English naturalists, that for information in regard to one of the most common of their littoral animals, many points of which have been matters of doubt for many years, we should be obliged to turn to Russian and French publications for the little that has been made known, except in regard to the branchiæ. A few scattered and very short articles by Gray, Lankester, and Patterson, beside the work of Dr. Williams, are about all that English works afford us; while Brandt, Fischer, Milne-Edwards, Lebert, Cuvier and others have done far more, though much remains to be done.

The branchiæ have been thoroughly described by Dr. Williams in the paper before referred to, though a careful dissection of the gill of *Acmæa* is still a desideratum. In *Patella vulgata*

they consist of a row of alternately large and small laminæ, of a suboval shape, flattened or slightly concave on one side, and rather prominently convex on the other; each composed of two walls of very thin vascular membrane united by a somewhat denser layer at the outer border, and filled with fluid (whether water or natural serous fluid being yet undetermined) while they they are still further strengthened by a series of internal fibres which cross each other like the braced timbers of a worked-out mine. The external surface of the branchiæ is ciliated, and the whole mechanism presents analogies with the gills of Lamellibranchs. It is probable that the lamellæ of the gill in *Acmæa*, though differently placed, are of essentially similar construction, while differing in form. The blood is transparent and the corpuscles are very small.

According to Dr. Williams, the lining membrane of the branchiæ is continuous, and it is highly improbable that water penetrates into the system as in some other mollusca. Lankester (An. Nat. Hist. 3d ser. xx, p. 334, 1867) describes two orifices, (capito-pedal), "one on each side of the head, in the angle formed by its junction with the muscular foot, and opening into the blood sinus surrounding the pharyngeal viscera." He also describes a communication which he supposes to exist between the "pericardium and the supra-anal articulated sac," or accessory renal organ.

My opportunities for examination of the present species having been confined to alcoholic and very limited material, I do not assume to speak positively in this matter, but can only say that the most careful search, assisted by injections from within, and the most thorough scrutiny of all the external anterior surface of the animal with a high power, failed to disclose either of the orifices alluded to. Moreover the search was not confined to this species, but was made in every species, and even specimen, examined, with a like result. In *Collisella patina* the heart is situated behind the left side of the head, very far to the left, and entirely away from the renal sac, which last is much smaller than in *Patella vulgata;* hence it appears highly improbable that any communication whatever exists between them; and if this be the case in a species closely allied, it adds to the improbability of the existence of such a communication in the present species. Mr. Lankester's paper is so exceedingly brief that it is not easy to follow his dissections, and it is greatly to be desired that a fuller account, with figures, which he promises, should be published. There is a bare possibility that the contraction of the specimens may have entirely obscured and closed up the openings of the supposed "capito-pedal orifices," or they may not exist in the

Acmæidæ; but, after the examination of a large multitude of specimens, I regret that I cannot confirm his observations in these two particulars.

The nervous system has been examined by Garner, Rhymer Jones and Anderson, and, later and much more thoroughly and correctly, by Brandt (Bull. Acad. Sci. St. Petersburg, Nov. 24, 1868). The whole system is naturally arranged in two groups, the *cerebro-pharyngeal* and the *pedo-branchial* nerves and ganglia. These two groups are connected on each side by two slender commissures. The principal ganglia of the first group are the *cerebral* and *pharyngeal;* of the second, the *ganglia pedalia* and *visceralia*. The whole paper is so concise, and the nervous system so intricate, that the student is referred to the original, should more detailed information be required. Dr. Brandt having set at his work with the preconceived notion of the close affinities of *Chiton* and *Patella*, finished without changing his mind on the subject; but the unprejudiced student, on comparing the figures of the nervous system of *Chiton fascicularis* upon the same plate with that of *Patella*, will hardly be disposed to agree with him. Indeed, the further the embryology and minute anatomy of the two groups are carried, the more evident does their dissimilarity become.*

It is not a little astonishing that, of all the authors who have commented upon the nervous system of *Patella* as given by Cuvier, not one seems to have recognized the fact that it is not that of *Patella vulgata* at all, but (probably) that of *Patina pellucida*, an animal belonging to a different genus. Some of the discrepancies may be reconciled when the latter comes to be dissected. Neither of the species dissected by Cuvier can be recognized by anything in his article as published in the "Memoires." They are generally supposed, however, to be *vulgata* and *pellucida*. In noticing the optic nerve Dr. Brandt calls attention to the fact that the eyes are situated upon the superior surface of the base of the tentacle, and not upon a tubercle at the outer base, as usually stated, and, I may add, not upon the prominent tubercle at the inner base, as Cuvier supposed.

The digestive system has been treated by Cuvier and Lankester. The latter has added little to the labors of his predecessor, and appears not to have read his "Mémoire," or at least to have overlooked the descriptions and figures (p. 18, pl. ii, f. 7, 12) of the crop and salivary glands, as he claims them as a discovery of

* Nevertheless, the typically molluscan nature of the nervous system of *Chiton*, and the fact that it is somewhat allied to the Patellidæ, may be considered as proven by Brandt's investigations. There is room for investigation with regard to possible affinities with Brachiopoda.

his own. I would remark, by the way, that the size of the latter differs in different individuals of the same species, or perhaps in the same individual at different times. The orifice of the anus is simple, but, in most species, a number of subcylindrical papillæ or tubercles are noticeable inside of it. The latter part of the rectum in *Acmæa* is repeatedly constricted, so that the fæces are expelled in sausage-shaped pellets. The renal organ, as shown by Lankester, is double; one of the two sacs, however, is nearly abortive, and seems almost imperceptible in some species of *Collisella*. These sacs empty by two papillæ, in *Patella*, one on each side of the anal tubercle; in *Collisella* there is no papilla to the left of the anus, but a non-elevated, simple, very minute orifice, sometimes much further (to the left) from the anus than the papilla on the right side. Cuvier does not mention the left hand one in the text, but it is represented on the plate in its proper place (fig. 8, pl. 2).

I have not been able to have access to the paper of MM. Robin and Lebert, who have noticed the generative organs. Mr. Lankester gives some particulars in regard to them. The ovary has been frequently mentioned, and I have elsewhere described the male gland of *Collisella*.* The oviduct mentioned by Cuvier seems to be wanting, though I have several times thought that I detected a slender, exceedingly thin duct proceeding from the extreme left of the gland and opening into the dendritic renal sac. I cannot say that I feel sure of this, however, as the condition of the specimens was unsatisfactory, from the spirit in which they were preserved. There does not appear to be any other opening through which the young can be extruded, and I am inclined to believe that some such duct exists and will eventually be demonstrated. If the "capito-pedal orifices" exist, they must be far too small to admit of the extrusion of the young mollusk with its shell, as described by Fischer.

To the latter naturalist we owe the whole of our very slender knowledge of the development of *Patella*. He found the ovaries filled with young mollusks in the month of March, and in April the rocks and the parent shells were covered with a multitude of young Patellæ, about one millimetre in length. This disproved the idea that the eggs were deposited in a single mass, and showed that the method of extrusion rather resembled that of *Chiton*.

It is extremely desirable that the development of this animal should be observed from its early stages, and after that, it is to be hoped that some careful anatomist will give to the world an account of the anatomy, on the plan of Mr. Hancock's magnificent paper on the *Brachiopoda*. It is by no means impossible

that some of the views here brought forward may prove ill-founded; yet, if their publication incites some naturalist (more favorably situated than myself for examination of the living animal) to give to the world a thorough monograph of any species of the order, I shall not regret their refutation. In any case, I would urge most strongly on all observers the duty of doing what they can to dispel the prevalent uncertainty in regard to the questions alluded to, which have too long demanded investigation, yet failed to obtain it.

PATELLA PENTAGONA, (Born.), Rve. Plate 15 fig. 22.

Patella pentagona, (Born. Mus. t. Vindobonensis, pl. 15, f. 4, 5). Rve. Conch. Icon. pl. xx, f. 48, a, b, c, 1854.
Patella stellæformis, Rve., Conch. Systematica.
Patella cretacea, Rve., Conch. Icon. pl. xxi, f. 53, a, b.
Patella tramoserica, A. Adams, (? Chemn., not of authors), Annals Nat. Hist., ii, 1868, p. 369.
Patella paumotensis, Gld., Proc. B. S. N. H. ii, p. 150, 1846. Expedition Shells, 8, Moll. U. S. Ex. Ex. p. 339, fig. 440-*a* to *e*.

Animal with the foot gamboge yellow, remainder of the body pale yellow; muzzle reddish; cirri of the mantle opaque white.* Foot large; mantle margin narrow, cirri disposed in twenty-four clusters of five each, two short ones arising from the margin, two rather longer from the inner mantle-edge, and between these a fifth twice as large as the others. Head slender, produced. Branchiæ smaller in front, but not interrupted; tentacles moderate, slender. Anal, infra-anal and renal orifices well defined, small, short, but prominent. Formula, $\frac{0}{3(4\ 2\cdot2\ 4)3}$.

Hab. Society Islands, Garrett. Paumotu Islands, Tahiti, Gld.

The dentition of this species allies it with the typical patellas of the type of *P. vulgata;* the branchiæ are similar; not interrupted in front, as Mr. Couthouy says, but continuous, as they are figured in the plates of the Ex. Exp.

Genus PATINELLA.†

Shell solid, porcellanous, with an erect subcentral apex. Cordon complete, equal all around; sides of foot provided with scalloped lappets. Teeth, $\frac{0}{3(2-1\cdot1-2)3}$. Inner uncinus plate-like, without a cusp. Second lateral the largest.

* Couthouy MSS.
† From *Patina*, a dish.

Type PATINELLA MAGELLANICA, Gmel. Plate, 15, fig. 24.

Patella Magellanica, Gmel., Syst. Nat. No. 52, p. 3703, 1792. Gualt. Test., pl. 9, f. E. Martini, Conch. Cab. i, pl. v, f. 40, a, b. Lam. An. s. Vert. ed. Desh. vii, p. 534, No. 26. Rve, Icon., pl. x, f. 19 a, b.

Patella fusca, Dillw., Cat. vol ii, p. 1047, No. 70.

Patella deaurata, Gmel., Syst. Nat., p. 3719, No. 142. Lam. 1819, An. s. Vert., vi, p. 330, No. 25. Ib. Ed. Desh. vii, p. 534, No. 25. Martini Conch. Cab. x, p. 168, f. 1616. D'Orb. Voy. Am. Merid. v, p. 480, No. 44. Gould, Expl. Exp. Moll., p. 341, f. 444, 444 a.

Patella ferruginea, Wood, Ind. Test., No. 32. Hanley's Ed., p. 186, No. 32, pl. 37.

Soft parts. Foot nearly circular, dark slate color, with a row of leaf-like scalloped lappets all around, except below the head, integument soft and spongy; mantle yellowish, with irregularities and patches of color corresponding to the ribs and rays of the shell margin, fringed with stout, cylindrical, pointed beards or cirri, rather irregularly disposed in two rows, upon the thickened portion; they are purple at the base and yellowish at the tips. Head small, rosy-white above, whitish on neck and muzzle; tentacles long, (quite short in alcohol,) tapering, curved, rather bluntly pointed, yellowish white, with a purple stripe above, and rather swelled at the bases; eyes small on upper part of bases; branchiæ lamellæ produced, close-set, rather smaller on the anterior portion, but not interrupted in front; hood short. Muzzle small, short, transversely oval; mouth ditto; disk bordered with a double row of slender cylindrical papillæ, radiately striate, without a frill, indented below. Renal papilla subcylindrical, distinct, not sessile on the anal, which is larger, with slender subcylindrical papillæ projecting from the orifice. Infra-anal tubercle to the right, prominent, distinct, smaller than the anal. Formula, $\frac{0}{3(1+\frac{1}{2}-1\cdot1-\frac{1}{2}+1)3}$.

Gould unites *deaurata* and *Magellanica* as varieties of one species under the former name; but if, as seems probable, the two are identical, the latter name should be used, as it precedes *deaurata*, both in the Syst. Nat. and the Conchylien Cabinet, in both text and plates. The latter work, however, not being binomial, should not be quoted as an authority for specific names. *Patella ferruginea*, Wood, according to Hanley, is identical with *deaurata*, and also *P. fusca*, Dillwyn, but not the *fusca* of Gmelin. Gould separates *ferruginea*, however, as a distinct species by the animal. This genus differs essentially from *Patella*, as typified by *P. vulgata*, in anatomy, external characters and dentition.

It is not improbable that a large number of tropical species will eventually be referred to it, when their soft parts shall have been examined. Pending such an examination, it is not worth while to so refer any species which have not been dissected, even provisionally. I suspect, however, that *P. granularis* and some allied forms will be found to agree more nearly with *Patinella* than with *Patella*, as restricted.

PATINELLA, sp. indet. Plate 15, fig. 25.

Mantle bordered with two rows of fleshy elongated papillæ. Foot with a scalloped flounce or frill extending all around except under the head. Muzzle short, broad; disk fringed with beautifully arborescent papillæ; indented below.

Anus prominent, stellate with five rays, richly papillose inside; renal and infra-anal papillæ small, inconspicuous, close to anal.

A specimen of a very large *Patinella*, without any shell or number by which the species might be identified, was found in the bottle with known Magellan species. It afforded a second opportunity of figuring the dentition of this genus, and was noteworthy in the particulars just mentioned.

Genus NACELLA, Schum.

Nacella, Schum., Essai d'un Nouv. Syst. 1817, p. 179. Gray, P. Z. S. 1847, p. 165: in Patellidæ. Ibid., Guide Moll. 1857, p. 169: in Tecturidæ.

< *Nacella*, Chenu, Man. de Conchyl. i, p. 378. Woodw., Man. p. 155. Ad., Gen. Rec. Moll. i, p. 467; in Patellidæ. Cpr., Lect. 1860, p. 70. Second. ed. p. 72.

Shell with the apex submarginal, anterior; pellucid, thin or corneous; animal with the cordon complete before and behind, the laminæ persistent but diminishing in size before the head. Sides of the foot provided with scalloped lappets. Teeth, $\frac{0}{3(2-1-1-2)3}$. Second and third laterals large, subequal.

Notwithstanding the manner in which Gray has treated this genus, which would lead, by implication, to the belief that he had not only examined the external parts of the animal, but also the dentition, the weight of evidence is too great to be disregarded, and I believe Deshayes to be correct in identifying the type *Nacella mytiloides* of Schumacher with *P. cymbularia* of Lamarck, which becomes a synonym of *mytilina*, Gmelin.

Type NACELLA MYTILINA, Gmel. sp. Plate 16, fig. 26.

Patella mytilina, Gmelin, Syst. Nat. 1792, vol. i, part vi, p. 3698, No. 28. (Favart d'Herbigny, Dictionnaire

d'h. Nat. Test. 2, p. 238, 239, Paris, 1775; Martini, in Neueste Mannigfaltigkeiten, Berlin, 1778, p. 417, t. 2, f. 13, 14; Helbling, Abh. einer Privatges, in Böhmen, vol. iv, p. 104, t. 1, fig. 5, 6: 1780, Prag. *fide* Gmelin, op. cit.)

Patella mytilina, Schub. and Wagn., Sup. Martini, pl. 229, f. 4052, 4053, Nürnberg, 1829. Desh. Ed. An. s. Vert. 1836, p. 541, No. 45.

Patella conchacea, Gmelin, Syst. Nat. 1792, vol. 1, part vi, p. 3708, No. 86. (Martini, in Nueste Mannigf. p. 417, t. 2, f. 13, 14, Berlin, 1778; *fide* Gmelin).

Patella conchacea, Bosc., Cours Compl. d'Hist. Nat. Paris, iii, p. 206, 1800. Leuckart, Isis, xvi, Col. 719, No. 3, 1825. Schum., Essai, p. 179. Schröt., Einl. p. 482, No. 100.

Nacella mytiloides, Schum., Essai, p. 179, pl. xxi, f. 3. Leuckhart, Isis, xvi, 1825, Col. 719, No. 3. Gray, Guide, p. 169.

Patella mytiloides, Desh., An. s. Vert. vii, p. 541, No. 45, 1836.

Patella cymbularia, Lam., An. s. Vert. vi, p. 335, No. 45, 1819. Ed. Desh., 1836, vii, p. 541, No. 45. Blainv., Mal. pl. xlix, f. 6. Chenu, Man. de Conchyl. i, p. 378, f. 2846. Gld., Moll, U. S. Expl. Exp. p. 341.

Patella cymbuloides, Gld., *op. cit.* in syn. (as of D'Orb.) erroneously.

Nacella cymbalaria, H. and A. Ad., Gen. Rec. Moll. i, p. 467, pl. lii, f. 10 a.

Soft parts: foot regularly oval, rather broader before, pale slate color on the sole, yellowish near the edges, finely granulated. Mantle edge thick, smooth, purplish, furnished with three rows of retractile filaments, arranged in quincunx order in relation to each other, the inner row the largest; one of these filaments, at the extreme posterior end of the animal, seemed considerably larger than the rest, like a tail. The larger cirri are tinged with purple at the base, the remainder yellowish. Branchial lamellæ small, yellowish, very fine and close set, diminishing anteriorly, and very small in front of the head, but not interrupted. Hood large, much prolonged, thin, very varicose. Head small, pale brown. Muzzle very long, almost proboscidiform; edge papillose, disk radiately granulose, destitute of any frill or lappets; mouth subcircular, entire; buccal lips double on each side. Tentacles moderately long, stout and bluntly pointed, pale brown. Renal papilla rounded, conical,

small close to anal, aperture minute; anal do., larger, furnished with papillæ inside the orifice; infra-anal do., smaller at the extreme right. Eyes small, on external base of tentacles. A puckered frill exists on the sides of the foot, extending all around except under the head. Formula, $\frac{0}{3(\frac{2}{2}-\frac{1}{2}\cdot\frac{1}{2}-\frac{2}{2})3}$.

Lives on floating fuci near Cape Horn.

This remarkable species was early known to naturalists, although its range appears to be comparatively limited; as far as we know, it is confined to the shores of Tierra del Fuego and the Straits of Magellan, where it finds a congenial home among the giant sea weeds for which that coast is noted. It is the analogue of *Patina pellucida* of Britain, but the arrangement of the teeth and branchiæ being quite different, they cannot even be placed in one genus.

This species, described by Gmelin under the name of *Patella mytilina* in one part of the Syst. Nat., is further on described again under the name of *P. conchacea*, with the identical references to Martini's paper which he had used in the first instance. Lamarck afterward gave it the name of *cymbularia*, by which it is best known; while Schumacher's name, *mytiloides*, though given before that of Lamarck, has been frequently quoted as a synonym of the latter. The references given by Gmelin are all to non-binomial authors, and the name *mytilina*, having ten pages precedence of *conchacea*, has been here adopted. I have been unable to discover the name *cymbuloides* in D'Orbigny's work, which Gould quotes as a synonym. No other species is at present known, and the forms from the west coast of North America which have been called "*Nacella*" will be distributed in different groups, but probably most of them will find a place in *Collisella*.

The colors are from Couthouy's notes, taken from the living animal, the anatomical details from specimens collected by him.

Genus HELCION, Montfort.

Helcion, Montf., Conch. Syst. 1810, ii, p. 62. Blainv., Malac. 1825, p. 499. H. and A. Ad., Gen. Rec. Moll. i, p. 460, ii, p. 657, 1854. Gray, Guide, p. 176. P. Z. S. 1847, p. 168. Cpr., Lect. Second. Ed. p. 72.

< *Helcion*, Chenu, Man. de Conchyl. i, p. 375. (?) Meek, Check List Cret. Inv. U. S. p. 17, 1864.

Patelloidea sp., Cantraine, Bull. Ac. Sci. Brux. 1835.

Helcium, Meek and Hayden, Am. Journ. Sci. and Arts, vol. xxix, second series, p. 83 (? err. typog.)

Not *Helcion*, Stoliczka, Pal. Indica, ii, p. 323; Pictet, Mat. Pal. Suisse, 3me ser. p. 717; nor D'Orb., Voy. Am. Mer. v, p. 703; nor Jeffreys, Brit. Conch. iii, p. 242.

"Shell ovate, radiately ribbed (pectinated); apex submarginal, anterior; aperture ovate; edge crenated. Gill interrupted over the head, of small and filiform strands." Gray, Guide, p. 176.

Type HELCION PECTINATUS, Lin.

Gmelin, Syst. Nat. i, part vi, p. 3710, No. 93.

Habitat. Mediterranean.

The shell of this unique and typical species is distinguished by its pectinated ribs and a "peculiar glazed deposit" on the interior of the aperture (Ad., *op. cit.*) The animal has not been examined thoroughly, and nothing is known of its dentition. Until further information is brought forward it can hardly be united with the genus *Patina*, as has been done by Jeffreys.*

HELCIONISCUS, nom. subg. prov.

Shell solid, heavy, moderately elevated, with a subcentral inconspicuous apex. Cordon interrupted in front, ending abruptly on each side, at the anterior ends of the adductor. Sides of foot and mantle edge smooth. Teeth $\frac{0}{3(2-1.1-2)3}$. The inner uncinus hardly raised above the level of the ribbon, and second lateral largest, as in *Patinella*.

Type HELCIONISCUS VARIEGATUS, Dall. ex Rve. Plate 16, fig. 27.

Patella varieyata, Rve. Conch. Syst. ii, pl. 136, f. 1. Conch. Icon. pl. xvi, fig. 36, a, b, c. (*Hab.* Australia, in error?) Savigny, Egypt, pl. 1, f. 3. Fischer, Journ. de Conchyl. x, April, 1870, p. 167, No. 42. (Suez.)

Soft parts; foot large, oval, thin, sole lead-colored, sides smooth, yellowish; mantle dotted with brown and with brown

* Stoliczka (Pal. Indica, ii, p. 321) proposes to arrange the fossil limpets under *Helcion*, *Nacella*, *Tectura* and *Patella*, according to the external characters of the shell. As it is absolutely impossible to determine the true affinities of these remains, from the characters preserved in a fossil state, such a plan is doubtfully expedient, as it implies a knowledge which is not attainable. It would be preferable, perhaps, to refer all the fossil forms to *Patella*, with a query, rather than to give names implying the existence of characters which can never be determined. Paleontology, in a great measure, does not admit the prosecution of the only satisfactory methods of zoological research, and hence must ever remain far behind them.

maculæ on the upper edge corresponding to the rays of the shell, edge somewhat irregular, resembling the shell margin, apparently quite smooth, and destitute of beards or filaments. Branchial lamellæ large, not crowded, large and small alternately, terminating anteriorly on each side close to the end of the adductors. Hood smooth, thin, very varicose, as is the thin inner part of the mantle. Head prominent, tentacles short, pointed, slender, bases somewhat swollen, with the eyes on the upper posterior portions. Muzzle short, transversely oval, without a frill, disk slightly granulose, especially at the edges, mouth large, rounded, buccal lips conspicuous; jaw thin, pale yellow, edge somewhat irregular from use; anal and infra-anal papillæ close together on the right-hand side, long, slender, cylindrical; anal orifice simple, not papillose internally, infra-anal bifid at tip, renal smaller than the others on the left side of anal papilla. Intestine full of red matter, probably from corallines; fæces expelled in cylindrical pellets. Crop moderate, a third as long as the body. No "capito-pedal" orifices to be detected internally, externally, or by injections. Radula coiled near the buccal mass, on the inferior surface of the liver. Formula, $\frac{0}{3(1+\frac{1}{2}-1\cdot1-\frac{1}{2}+1)3}$.

Locality. Red Sea and Gulf of Akaba, Smithsonian Cabinet.

The peculiarities of the shell of *Helcion* render it probable that it differs generically from the group under consideration, although the branchiæ exhibit points of resemblance, and I am inclined to believe that such of the species, now included under *Scutellina*, as cannot be affiliated with the *Acmæidæ*, may find a resting-place in the genus *Helcion*.

The *Helcionisci* are tropical forms most nearly allied to *Patinella*.

HELCIONISCUS ROTA, Rve. Plate 16, fig. 28.

Patella rota, Chemn. Conchyl., Cab. x, p. 330, pl. 168, fig. 1619. Rve Conch. Icon., pl. xvii, 39 a, b, c. ? = *H. variegata*, Rve., *ante*.

Animal in every respect resembling the last. The teeth, which are figured in a slightly different position from those of *H. variegatus*, Rve., do not exhibit any differences of value. I am inclined to think that they may be identical, in which case, the species will take the name of *H. rota*, which has priority over *variegatus*. The species before me is undoubtedly the former.

Hab. Madagascar, Caleb Cooke.

HELCIONISCUS (?) ARGENTATUS, Gray, sp.

Patella argentata, Gray, Moll. Beechey's Voyage, p. 148, pl. 39, f. 7. Gould, Expl. Exp. Moll., p. 345, pl. 29, f. 451.

Nothing is said about the extent of the branchiæ in the diagnosis, but they appear by the figure to be interrupted behind the head.

HELCIONISCUS EXARATUS, Nutt. Plate 16, fig. 29.

Patella exarata, Nutt., Jay's Cat., p. 38. Rve. Conch. Icon. pl. xix, fig. 47, a, b, 1854.
Patella sandwicensis, Pse., P. Z. S., 1860, p. 437.
Patella undato-lirata, Pse., ubi? MSS. label, Cab. S. I.

Mantle margin broad, thick, strongly crenate, conspicuously papillose. Sides of foot smooth, blackish. Tentacles stout, rather long; muzzle papillose around the edges. Head small, short. Branchiæ interrupted between the muscles in front, close, prominent. Foot stout and muscular. General coloration dusky, lighter in the commissures. Anal and other papillæ short but prominent. Inferior nuchal commissure deep and straight. Formula, $\frac{0}{3(2-1\cdot1-2)3}$.

Hab. Sandwich Islands, Pease, Garrett.

The so-called species of Mr. Pease are not even distinguishable varieties, and have no characters by which they can be differentiated from the typical *exarata*. The description of the first is in English, without a figure. I have not been able to find a description of the second.

Genus PATINA, Leach.

Patina, Leach, MSS, 1819. Gray, Syn. Brit. Mus., 1840. Moll. Gt. Brit., 1852, p. 223. Guide, Moll., p. 175. Syn. Brit. Mus., Ed., 1842, p. 90.
Patella, Loven, Ofv. K. Vet. Ak. For., 1847, p. 198.
< *Nacella*, H. & A. Ad. i, p. 467, 1854. Chenu, Man. de Conchyl., i, p. 378. Woodw. Man., p. 155. Cpr. Lect. Moll., p. 72.
Helcion, Jeffreys, Brit. Conch., iii, p, 242. (Not Montfort.)
Ansates, Sby., Conch. Man. Ed. ii, p. 68, 1842. (Not Klein.)
? Goniclis, Raf. (See Syn. *Patella*.)

Animal with the branchial cordon interrupted in front; teeth with the inner two series parallel, third series with a larger denticulate cusp, posterior; radula furnished with three uncini on each side. Formula, $\frac{0}{3(\frac{1}{3}-2\cdot2-\frac{1}{3})3}$. Shell with the apex subterminal, anterior; smooth, thin, semi-pellucid or horny in texture.

Should the details of the soft parts and dentition of *Helcion* (*pectinatus*) prove on examination to agree with those of the

type of this genus, they must be consolidated, but, pending such an examination, in view of the considerable conchological differences which exist, this would be hardly admissible. The dentition and interrupted branchiæ separate it definitely from the genus *Nacella*, although the shells are very similar. It is not probable that any of the species of "*Nacella*" from the northwest coast are congeneric.

Type PATINA PELLUCIDA, Linn., sp. Pl. 16, fig. 30.

Patella pellucida, Lin., Syst. Nat. xx, 1260.
Patella lævis, Penn, Brit. Zool. iv, p. 144, pl. xc, fig. 151.
Patella cærulea, Pult., Cat. Dorset., pl. xxiii, f. 6.
Patella bimaculata, Mont., Test. Brit., p. 482, pl. xiii, f. 8.
Patina lævis, Leach, Moll. Gt. Brit., p. 224, No. 1.
Patina pellucida, Leach, ib., p. 224, No. 2.
Patella cæruleata, Da Costa, Brit. Conch. p. 7, pl. 1, f. 5, 6.
Patella elongata, + *elliptica*, Flem., Ency. Edin. pl. 204, fig. 2, 3.
Patella cornea, Pot. and Mich., Gal. Donai. Moll. p. 525, pl. xxxvii, f. 5, 6.
Patella intorta, Pennant, + *P. minor*, Wallace, fide Jeffreys.
Helcion pellucidum, Jeffreys, Brit. Conch. iii, p. 242.

Soft parts. Foot oval, sole yellowish white edged with a narrow brown line, body cream color with a tinge of brown in front; mantle often bordered with a grey or lead colored line, fringed with fine white cirri, alternately long and short; gills whitish, interrupted in front of the adductor; mouth minutely puckered, head small; tentacles slender, long; eyes small, on their outer bases. Habitat upon the stalks and fronds of large fuci, British and North European Seas.

I have not been able to obtain specimens of the soft parts, and have quoted from Jeffreys and others; the dentition is from Lovèn.

Although the shells are very similar, the animal differs strongly from that of *Nacella*. Clark makes the statement that the orifices of the anal and genital papillæ are below the right tentacle on the side of the neck, not on the side of the body as in other species, but this requires confirmation, and is probably an error. There are a number of other species which will probably find a place in this genus; they are now usually termed *Nacella*.

Genus METOPTOMA, Phillips.

Metoptoma, Phil., Geol. Yorksh. ii, p. 223, 1836. Leonh. and Bronn., Jahrb. p. 750, 1841. Morris, Br. foss. p. 151, 1843. Woodw., Man. p. 155. Stoliczka, Pal. Indica, ii, p. 324. Eichw., Leth. Ross. i, p. 1098.

Not *Deslongchampsia*, as per Chenu, Man. de Conchyl. i, p. 376; nor *Patella*, Ib. i, p. 375, fig. 2281.

Shell patelliform, scar horseshoe shaped; apex subcentral, shell truncate behind the apex, with the posterior margin broadly emarginate or waved, and the anterior slope the longest.

Type *M. pileus*, Phil., l. c. p. 224, pl. xiv, f. 7. Carb. lime stone, Great Britain.

This genus, characterized by the extraordinary *posterior* truncation, is only known from the older rocks in a fossil state.

Chenu wrongly places it as a synonym of *Deslongchampsia*, McCoy, (though having eighteen years priority!) with which it cannot be affiliated. His figure of *Patella solaris*, de Kon., represents a typical *Metoptoma*, but not the type of the genus, a statement I wrongly attributed to Mr. Meek, in this Journal vol. vi, p. 20. Stoliczka compares *Capulus Troscheli*, Mull., from the Aachen cretaceous beds, with *Metoptoma*, which it appears to resemble. A number of the species referred by Billings (Pal. Foss. Can. Geol. Survey) to this genus, are evidently not congeneric.

LIST OF FIGURES.

Plate 14.

1. *Acmæa mitra*, Esch. Original.
2. " *virginea*, Müll. Confirmed from Lovèn's figure.
3. " *insessa*, Hinds. Original.
4. *Collisella patina*, Esch. Original.
5. " *strigatella*, Cpr. Original; a, uncinus.
6. " *pelta*, Esch. Original.
7. " *asmi*, Midd. Original; a, uncinus.
8. " *persona*, Esch. Original.
9. " *mitella*, Mke. Original.
10. " *spectrum*, Rve. Original.
11. " *fascicularis*, Mke. Original.
12. " *scabra*, Rve. Original; a, uncinus.
13. " *testudinalis*, Müll. Original.
14. " *subrugosa*, D'Orb. Original.
15. " *atrata*, Cpr. Original; a, uncinus.

Plate 15.

16. *Colisella pediculus*, Phil. Original; a, uncinus.
17. " *Borneënsis*, Rve. Original; a, uncini.
18. " *saccharina*, Lin. Original; a, uncini.
19. *Scurria mesoleuca*, Mke. Original; a, uncinus.
20. *Lottia gigantea*, Gray. Original.
21. *Ancistromesus Mexicanus*, B. & S. Original.
22. *Patella pentagona*, Born. Original.
23. " *vulgata*, Lin. Original.
24. *Patinella magellanica*, Gmel. Original.
25. *Patinella*, sp. indet. Original.

Plate 16.

26. *Nacella mytilina*, Gmelin.
27. *Helcioniscus variegatus*, Rve. Original.
28. " *rota*, Original.
29. " *exaratus*, Rve. Original.
30. *Patina pellucida*, Lin, after Lovèn.
31. a, muzzle of *Acmœa;* b, do. of *Collisella;* c, do. of *Patella.*
32. a, profile of teeth of *Acmœa;* b, do. of *Collisella.*
33. a, jaw of *Collisella;* b, do. of *Patinella.*

Plate 17.

34. *Collisella sybaritica*, Dall.
35. " (*? patina* var.) *ochracea*, Dall.
36. " *pelta*, var. *nacelloides*, Dall.
37. " (*Collisella* ?) *hieroglyphica*, Dall.
38. " *Collisella Borneënsis*, Reeve.